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PART I – GENERAL

Contractor shall furnish all labor, equipment, and materials required for environmental protection during and as the result of construction operations under this Contract except for those measures set forth in other provisions of these Specifications. Environmental protection requires consideration of air, water and land, and shall also include monitoring and abatement of odors generated during soil excavation and storage.

1.1 Submittals

- (A) Implementation Plan. Prior to commencement of the Work, Contractor shall:
 - i. Submit in writing a plan for implementing this Section.
 - ii. Meet with Engineer to develop mutual understandings relative to compliance with the provisions of this Section and administration of the environmental protection program.
- (B) Best Management Practices (BMP) Plan. Before work begins, Contractor shall apply for a KPDES general construction permit and prepare and abide by a BMP Plan, prepared in accordance with the requirement of the general permit. Contractor shall reference Section 01 57 13 for further details necessary to comply with the BMP Plan. The plan shall include location and construction details of Contractor's proposed dikes, basins, perimeter controls, silt fencing, check dams, etc. In addition, Contractor shall provide and submit the location and control measures for stockpiled material.

PART 2 – MATERIALS (NOT USED)

PART 3 – EXECUTION

3.1 General

- (A) Limits of working areas include areas for storage of construction material and shall be cleared in a manner which will enable satisfactory restoration and will not affect the environment during or after the construction period. Contractor shall not enter beyond the working limits of the working area except with written approval of Engineer and Owner.
- (B) The location of areas for storage of Contractor's materials required temporarily in the performance of the work shall be within the limits of the working area and shall require written approval of Engineer prior to use. The preservation of the existing landscape shall be an imperative consideration in the selection of the sites.
- (C) Contractor shall obliterate all signs of temporary construction facilities such as work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, temporary erosion and sediment controls, or any other vestiges of construction. Disturbed areas shall be graded and filled as required, topsoil shall be spread to a depth of approximately six (6) inches over the entire area, and the entire area shall be seeded in accordance with Section 32 92 19.

3.2 Protection of Water Resources

- (A) Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the responsibility of Contractor to investigate

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and comply with all applicable federal, state, county and municipal laws concerning pollution of rivers, streams and impounded water. All work under this Contract shall be performed in such a manner that objectionable conditions will not be created in streams, lakes, reservoirs, or bodies of water adjacent to, or within, the Project area.

- (B) Surface drainage from cuts and fills within the construction limits, whether or not completed, from borrow and waste disposal areas, shall be held in suitable sedimentation basins or shall be graded to control erosion within acceptable limits if turbidity producing materials are present. Temporary erosion and sediment control measures such as perimeter controls, berm, dikes, or sedimentation basins, if required to meet the above standards, shall be provided and maintained until permanent drainage controls and /or permanent vegetation is established. The area of bare soil exposed at any time by construction operations should be held to a minimum.
- (C) Contractor shall apply specified temporary seed mix and/or soil stabilization blanket, as appropriate, on denuded ground immediately after rough grading is completed. This shall apply to all areas not subject to appreciable traffic during construction and shall include even those that are to receive some form of construction later, if ground is to be exposed 30 days or more.
- (D) Stream and drainage ditch crossings by fording with equipment shall be limited to control turbidity, and in areas of frequent crossings, temporary culverts or bridge structures shall be installed. Any temporary culverts or bridge structures shall be removed upon completion of the Project. Fills and waste areas shall be constructed by selective placement to eliminate silts or clays on the surface that will erode and contaminate adjacent streams.
- (E) At all times of the year, special measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, waste washing, herbicides and insecticides, and cement and surface drainage from entering public or private waters.
- (F) Disposal of any materials, wastes, effluent, trash, garbage, oil, grease, chemicals, etc., in or adjacent to reservoirs, streams or other waterways shall be disposed of by Contractor as specified in these Contract Documents. If any waste material is dumped in an unauthorized area, Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated soil shall be excavated, disposed of as specified herein before, and replaced with suitable fill material, compacted and finished with topsoil, all at the expense of Contractor.

3.3 Maintenance

- (A) Contractor shall dispose of all discarded debris, aggregate samples and concrete test samples from any source whatsoever, in a manner approved by Engineer. Toilet facilities shall be kept clean and sanitary at all times. Services shall be performed at such a time and in such a manner to least interfere with the operations. Services shall be accomplished to the satisfaction of Engineer.
- (B) Contractor shall frequently remove materials no longer required on the site, such as excess excavated material, forms, pipes, temporary structures and similar materials and equipment so that the site, access routes to the site, and any other work areas shall present a neat, orderly, workmanlike appearance at all times.

- (C) Before final payment, Contractor shall remove all surplus materials, false work, temporary structures, including foundations thereof, plants of any description, and debris of every nature resulting from his operations, and put the site in a neat, orderly condition; and restore all work areas which have been used for or disturbed to their original condition or to a condition satisfactory to and approved by Engineer.

3.4 Disposal

- (A) Contractor shall legally dispose of waste materials and materials determined by Engineer to be waste in an approved disposal site in a manner meeting all federal, state, and local regulations.
- (B) All costs related to disposal, including but not limited to dump fees, permits, etc., will be the responsibility of Contractor.
- (C) Contractor shall immediately inform Engineer of any hazardous materials encountered during construction and legally dispose of such hazardous materials at an approved disposal site.

END OF SECTION 01 56 10

PART I – GENERAL

Contractor shall furnish all material, labor and equipment necessary for the proper installation, maintenance, inspection, monitoring, reporting, and removal of temporary erosion prevention and sediment control measures detailed on the Drawings, required by the Technical Specifications, or directed by Engineer in order to minimize the deposition of sediment into Waters of the Commonwealth.

I.1 Submittals

- (A) Prior to commencement of work, Contractor shall submit a complete list of materials proposed for the work and identify sources for materials.
- (B) Prior to commencement of work, Contractor shall submit a proposed sequence of operations and coordination with other work.
- (C) Contractor shall furnish copies of delivery tickets or other acceptable receipts as evidence of materials received and used to install temporary erosion prevention and sediment control measures.

I.2 Restrictions

- (A) Contractor shall abide by the Project SWPPP and Special Conditions as they relate to temporary erosion and sediment control and temporary environmental controls.
- (B) Runoff from all disturbed areas and sediment-laden groundwater encountered during trenching, boring or excavation must be routed through a silt control structure or sediment trapping device prior to discharge from the construction area and prior to entering a receiving stream or other water body. Acceptable sediment trapping devices include, but are not limited to silt fence, diversion berms and swales, inlet protection, check dams, silt basins, silt traps, and vegetative buffers.
- (C) Stockpiles shall be located away from streams, ponds, swales, and catch basins in locations provided on the Drawings or approved by Engineer. Soil stockpiles shall be seeded, mulched and contained through the use of silt fence.

PART 2 – MATERIALS

2.1 Silt Fence

- (A) The geotextile fabric shall conform to AASHTO M 288 for temporary silt fence.
- (B) Fabric height shall be 36 inches wide, such that 28 inches of fabric is above ground, after trenching.
- (C) Posts shall be either hardwood or steel and should be 42 inches in height. For hardwood posts, the cross-section should be a minimum of one and one-half (1.5) inch by one and one-half (1.5) inch and for steel, the cross-section should be a one and one-quarter (1.25) inch by one (1) inch T-section with projections to fasten wire and fabric in position.

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- 2.2 Diversion Berms with Rock Check Outlets. Contractor shall provide diversion berms with rock check outlets to divert clean runoff from disturbed areas. The diversion berm and rock check outlets shall be of the type indicated on the Drawings or as directed by Engineer.
- 2.3 Pump-Around
- (A) If possible, channel relocation work shall be completed prior to allowing flow to enter into the newly constructed stream channel.
 - (B) If a pump around is necessary to facilitate construction “in the dry” within a stream channel, the pump around shall be of the type indicated on the Drawings and shall be installed as indicated, or as directed by Engineer.
 - (C) It shall be the responsibility of Contractor to provide all necessary materials, including, but not limited to pipes/hoses, pumps, and all materials and apparatus required to maintain pumping activities as required during construction for the duration of the Project.
- 2.4 Temporary Seed
- (A) Quick cover specified for surface erosion control shall be a minimum of 95 percent pure live seed (PLS) in accordance with the Section 32 92 19 and as noted on the Drawings.
 - (B) Weed seed shall be a maximum 1 percent by weight of the total mixture.
 - (C) All seed shall be labeled in accordance with state laws and the US Department of Agriculture (USDA) Rules and Regulations under the Federal Seed Act.
 - (D) The mixing of seed may be done by the seed supplier or on site as directed. Substitutions will only be allowed if approved in advance by Engineer.
 - (E) Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.
 - (F) Temporary seed species and application rates are noted on the Drawings.
- 2.5 Straw Mulch
- (A) Straw mulch shall consist of wheat, barley, oat or rye straw, or tame hay.
 - (B) The straw mulch material shall be air-dry and of consistency to be broadcast by commercial straw-blowing equipment, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality.
 - (C) The use of straw mulch that contains noxious weeds is not permitted.
- 2.6 Hardwood Mulch
- (A) Hardwood mulch shall be chipped on site from crowns of trees and branches of shrubs cleared on site.
 - (B) The wood-chip mulch produced shall be stockpiled for subsequent use.

- (C) The wood-chip mulch shall not have two orthogonal dimensions exceeding three (3) inches.

2.7 Erosion Control Blanket

- (A) See Section 31 05 20.
- (B) Slopes flatter than 2:1. Coir Fabric Type III shall be used unless otherwise specified on the Drawings.
- (C) Slopes steeper than 2:1. Coir Fabric Type I or Type II shall be used unless otherwise specified on the Drawings.

2.8 Temporary Culvert Low Water Crossing.

- (A) Contractor shall provide pipes/culverts and rock to construct temporary low water crossings, limiting crossings by fording to minimize stream turbidity.
- (B) The temporary culvert low water crossing shall be of the type indicated on the Drawings or as directed by Engineer.
- (C) Pipes sizes shall be selected to convey stream base flow without appreciably altering the stream flow characteristics. Culvert should be as large as possible to minimize fill placement. Multiple pipes may be used.

PART 3 – EXECUTION

3.1 Preparation / Sequence

- (A) Due to the nature of the work required by this Contract, it is anticipated that the location and nature of the erosion and sedimentation control devices will be adjusted on several occasions to reflect the current phase of construction. The construction schedule adopted by Contractor will impact the placement and need for specific devices required for the control of erosion.
- (B) All work on all parts of the project shall minimize disturbance by machinery and shall only disturb vegetation if absolutely necessary.
- (C) Contractor shall develop and implement such additional techniques as may be required to minimize erosion and off-site sedimentation. The location and extent of erosion and sedimentation control devices shall be revised at each phase of construction that results in a change in either the quantity or direction of surface runoff from constructed areas. All deviations from the erosion and sedimentation control provisions shown on the Drawings shall have the prior written acceptance of Engineer.
- (D) Erosion and sediment controls shall be removed at the completion of construction.

3.2 Installation and Maintenance

- (A) Silt Fence. Contractor shall:
 - i. Prior to clearing, install silt fence down-slope of areas to be disturbed.

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- ii. Install silt fence down-slope of spoil areas to prevent sediment-laden runoff from entering streams or wetlands.
 - iii. Bury the bottom eight (8) inches of the fabric in a four (4) inch trench cut into the ground. Place posts at a maximum horizontal spacing of six (6) feet.
 - iv. Silt fence shall remain in place until permanent soil stabilization is established. Damaged, dislodged, or decomposed silt fence shall be repaired or replaced immediately. Silt fence shall be replaced at least every six (6) months.
 - v. Remove built up sediment from silt fencing when it has reached one-third ($1/3$) the height of the fence. Inspect silt fencing for depth of sediment, tears, secure fabric attachment, and fence post stability. Repair silt fence within 24 hours following inspection of damage.
- (B) Diversion Berms with Rock Check Outlets. Contractor shall:
- i. Install Diversion Berms with Rock Check Outlets as indicated on the Drawings or as directed by Engineer.
 - ii. Remove built-up sediment from behind the rock checks when it reaches one-third ($1/3$) the height of the rock check or when re-suspension is apparent.
- (C) Pump-Around. Contractor shall:
- i. Install pump-arounds as indicated on the Drawings or as directed by Engineer.
 - ii. Install a pump around system in locations depicted on the Drawings and/or chosen by Contractor and approved by Engineer that is adequate to pump average daily flow around construction activities.
 - iii. The pump around needs only to convey average daily flow; it is not intended to convey flood flows. Contractor is responsible for furnishing the correct size and number of pumps required to adequately de-water the channel. The number of pump-arounds may be increased, decreased, or eliminated entirely at the direction of Engineer.
 - iv. Variations in quantity and timing of installation will not be considered as alterations in the details of construction or a change in the character of the work.
 - v. Maintain sandbags and lines in good working order.
 - vi. Following the removal of the pump around, stabilize any disturbed areas.
- (D) Temporary Seed
- i. Temporary Seed species and application rates are noted on the Drawings.
 - ii. If area is not final graded and has not been disturbed within 14 days, Temporary Seed shall be installed according to SWPPP.

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- iii. When final grade is achieved, topsoil redistribution and seedbed preparation is required as indicated in Section 32 92 19.
 - iv. Seeding shall be accomplished by hand or using a broadcast spreader. Any alternative method of seeding must be approved by Engineer in writing.
 - v. Protection of seeded areas shall be the responsibility of Contractor. Protection shall be provided against traffic or other damage by erecting barriers or warning signs, as directed, until cover is established. Any damage shall be repaired.
- (E) Straw Mulch. Contractor shall mulch and tack all seeded areas within 12 hours after seeding with a weed-free straw at the rate of one and one-half (1.5) tons per acre.
- (F) Hardwood Mulch Berm (Wood Chips). Contractor shall:
- i. Remove obstructions such as tree limbs, large rocks, etc. prior to placement of the berm.
 - ii. Place Wood Chip Filter Berms at existing level grade. Extend both ends of the berm at least eight (8) feet up slope at 45 degrees to the main berm alignment. Do not locate Wood Chip Berms in areas of concentrated flow or used to construct sediment traps or other impoundments.
 - iii. The Berm shall be a minimum of one and one-half (1.5) feet in height and four (4) feet in width.
 - iv. Inspect Berms weekly and after each runoff event. Remove sediment when accumulations reach half the height of the berm. Replace damaged or deteriorated portions of the berm immediately upon inspection.
 - v. Berms may be leveled when the area has been permanently stabilized.
- (G) Erosion Control Blanket. Contractor shall:
- i. Install erosion control blanket (Coir Fabric specified in Section 31 05 20) along all stream reaches where excavation occurs as indicated on the Drawings.
 - ii. Spread seed and straw prior to placement of the blanket. Placement of the material shall be accomplished without damage to installed material or without deviation to finished grade.
 - iii. Provide protection against traffic or other damage by erecting barriers or warning signs, as directed.
- (H) Temporary Culvert Low Water Crossing. Contractor shall:
- i. Install temporary culvert low water crossings as needed to construct stream restoration and limit crossing streams and ditches by fording as indicated on the Drawings.
 - ii. Install the culvert to allow for overtopping within the confines of the stream channel (i.e. install with a dip in the cover within the confines of the stream channel).

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- iii. Install the culvert on the existing stream bed.
- iv. Install culverts with a length that extends the full width of the crossing, including side slopes. Minimize crossing width (culvert length) while allowing safe passage of required construction equipment.
- v. Pipes shall not be oriented such that flow is directed into a stream bank, causing erosion. Stabilize pipe outlets as necessary to prevent erosion.
- vi. Inspect temporary culvert weekly and after each runoff event. Remove any blockages. Replace fill stone as needed.
- vii. The structure shall be removed when it is no longer required to provide access to the construction area.

3.3 Inspection. Contractor shall:

- (A) Inspect erosion and sediment control devices (and create inspection reports) at least once every seven (7) calendar days and within 24 hours after each rainfall event of one-half (1/2) inch or more of precipitation. During inspection, check for areas where runoff has eroded a channel beneath the device, or where the device has been overtopped and/or collapsed. If an erosion and sediment control device becomes ineffective due to weathering, decomposition, or damage, then replace the affected section immediately.
- (B) Remove accumulated sediment when it reaches approximately one-third (1/3) of the height of the silt fence or check dam.
- (C) Take immediate action to correct deficiencies to erosion and sediment control devices. Owner reserves the right to stop all construction activities not related to erosion and sediment control devices until such deficiencies are repaired.
- (D) During inspections the following will be observed and appropriate maintenance procedures taken:
 - i. The conformance to Technical Specifications and current condition of all erosion and sediment control structures.
 - ii. The effectiveness and operational success of all erosion and sediment control measures.
 - iii. The presence of sediments or other pollutants in stormwater runoff at all runoff discharge points.
 - iv. If reasonably accessible, the presence of sediments or other pollutants in receiving waters.
 - v. Evidence of off-site tracking at all locations where vehicles enter or exit the site.

END OF SECTION 01 57 13

PART I – GENERAL

Contractor shall survey stake and layout the Project site with respect to grading operations, in-stream structures, fencing, planting limits, and permanent boundary monuments as detailed on the Drawings or required by the Technical Specifications. The work includes making all supporting computations and field notes required for control of the work as necessary to establish the exact position, orientation, and elevation of the work from control stations.

1.1 Submittals

- (A) Contractor shall submit verifiable evidence to Engineer that surveying shall be performed by qualified personnel, employed by or on behalf of Contractor, either under the direction of a Professional Land Surveyor in the Commonwealth of Kentucky or by someone that can demonstrate satisfactory experience in land surveying.
- (B) Contractor shall keep field notes in conventional, handwritten notebooks or in a computerized form acceptable to Engineer. The notebooks shall become the property of Owner upon completion of the Project. Field notes shall be submitted to Engineer every 14 days.

1.2 Protections

- (A) Contractor, through Contractor's surveyor or Engineer, shall be responsible for the accuracy of all layout and staking. All errors and discrepancies found on previous surveys, Drawings, or Technical Specifications shall be called to the attention of Engineer prior to proceeding with further survey and construction work.
- (B) The overall supervision of the construction staking personnel shall be the responsibility of Contractor. Any deficient survey layout or staking performed by Contractor's surveyor or Engineer, or any unreported errors in previous surveys that may result in construction errors, shall be corrected by Contractor at no additional cost to Owner.
- (C) Contractor is responsible for such layout and control work as may be required for construction of the proposed improvements. Layout and staking shall be provided as many times as necessary to accommodate Contractor's sequencing and schedule. Re-staking because of damage by construction activities, vandalism, or other losses shall be provided at Contractor's expense.
- (D) Contractor shall be responsible for protecting and preserving all property corners and survey control points (i.e. benchmarks and horizontal control points). If existing property corners or survey control points are disturbed, Contractor shall be responsible for the costs of re-establishing the information.
- (E) Contractor shall ensure all staking material, including flagging and other materials, is disposed of properly and does not become trash debris on site.

PART 2 – MATERIALS

- 2.1 Staking Materials. Furnish all staking materials of adequate quality for the purpose intended, including all stakes, paint, field notebooks, and all other materials necessary to properly perform the required work.

- 2.2 Stakes. Stakes shall be suitable for general field construction staking and shall be durable enough to last the duration of the Project without undue weathering so as to make the stake illegible or difficult to read or use. Stakes that become illegible shall be remarked or reset at Contractor's expense.
- 2.3 Paint. Paint, when used in lieu of plastic flagging to mark survey stakes, shall be brightly colored or fluorescent to be visible from passing equipment. Paint that becomes faded shall be remarked or reset at Contractor's expense.
- 2.4 Plastic Flagging. Plastic flagging shall be brightly colored or fluorescent plastic ribbon securely tied to the survey stake. Plastic flagging that becomes faded, torn or dislodged shall be replaced at Contractor's expense.
- 2.5 Notebook. Field notebooks shall be made of quality, heavy, water resistant paper and may be bound with a permanent binding or may be in loose leaf binding. Notes shall be made with a waterproof pen or pencil.

PART 3 – EXECUTION

- 3.1 Construction surveying shall be performed by qualified personnel, either under the direction of a Professional Land Surveyor in the Commonwealth of Kentucky or by someone that can demonstrate satisfactory experience in land surveying.
- 3.2 Engineer has established survey reference points and benchmarks shown on the Drawings. Line and curve layout and stakeout data will be provided by Engineer.
- 3.3 Contractor shall locate the control points established by Engineer and establish the necessary benchmarks for the proper layout and of grading operations and in-stream structures. It is Contractor's responsibility to locate, check, and verify control points and their accuracy.
- 3.4 Contractor shall make all calculations and furnish and place all layout stakes or markers. Contractor shall exercise care in the preservation of stakes and benchmarks and shall have them reset at Contractor's own cost if they are damaged, lost, displaced or removed.
- 3.5 Minor adjustments to suit field conditions are anticipated and it shall be the responsibility of Engineer to make decisions regarding adjustments. Any inspection or checking of Contractor's layout by Engineer and the acceptance of such shall not relieve Contractor of its responsibility to secure the proper alignment dimensions, grade, and elevation of the required work.

END OF SECTION 01 71 23

PART I – GENERAL

Contractor shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than prior to such damage or temporary relocation, all in accordance with the Contract Documents.

- 1.1 **Verification of Existing Conditions.** Contractor shall fully satisfy himself/herself as to the nature and location of the work, of any and all obstructions likely to be encountered, or any other matter which may affect carrying out the work. No information upon any such matters derived from maps, profiles, or Technical Specifications, or from Owner shall in any way relieve Contractor from all risk incident to the work. Contractor is responsible for verifying any site conditions that may have a bearing on their proposal.
- 1.2 **Rights-of-Way.** Contractor shall:
 - (A) Not do any work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure. Nor shall Contractor enter upon the rights-of-way involved until notified that Owner has secured authority from the proper party.
 - (B) After authority has been obtained, give said party due notice of Contractor's intention to begin work, if required by said party, and shall remove, shore, support, or otherwise protect such pipeline, transmission line, ditch, fence, or structure, or replace the same.
- 1.3 **Survey Markers.** Contractor shall not destroy, remove, or otherwise disturb existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall begin until all survey or other permanent marker points that will be disturbed by the work have been properly referenced. Survey markers or points disturbed by Contractor shall be accurately restored after street / roadway resurfacing is completed.
- 1.4 **Existing Utilities and Improvements.** Contractor shall:
 - (A) Take all possible precautions for the protection of unforeseen utility lines to avoid service disruptions and provide such special protection as may be necessary.
 - (B) Contact Kentucky 811 prior to excavation for utility marking. Contractor shall verify the exact locations and depths of all utilities shown and Contractor shall make exploratory excavations of all utilities that may interfere with the Work. Exploratory excavations shall be performed as soon as practicable after award of the contract and a sufficient time in advance of construction to avoid possible delays to Contractor's work. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility. When exploratory excavations show the utility location as shown to be in error, Contractor shall so notify Engineer.
 - (C) **Utilities to be Moved:** In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of Contractor, be notified by Owner to move such property within a specified and reasonable time. When utility lines that are to be removed are encountered within the area of operations, Contractor shall notify Engineer a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.

02 01 00 – MAINTENANCE OF EXISTING CONDITIONS

- (D) Utilities to be Removed: Where the proper completion of the work requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is indicated, Contractor shall remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to Engineer and the owner of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished by Contractor in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.
- (E) Owner's Right of Access: The right is reserved to Owner and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes to their property made necessary by the work of this Contract.
- (F) Underground Utilities Indicated: Existing utility lines that are indicated or the locations of which are made known to the Contractor prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired or replaced by Contractor, unless otherwise repaired by the owner of the damaged Utility. If the owner of the damaged facility performs its own repairs, Contractor shall reimburse said owner for the costs of repair.
- (G) Underground Utilities Not Indicated: In the event that Contractor damages existing utility lines that are not indicated or the locations of which are not made known to Contractor prior to excavation, a verbal report of such damage shall be made immediately to Engineer and a written report thereof shall be made promptly thereafter. Engineer will immediately notify the utility owner. If Engineer is not immediately available, Contractor shall notify the utility owner of the damage. If directed by Engineer, repairs shall be made by Contractor. Additional compensation for such work will be at the discretion of Owner.
- (H) Approval of Repairs: All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement owner before being concealed by backfill or other work.
- (I) Maintaining in Service: Unless indicated otherwise, oil and gasoline pipelines, power lines, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the work shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to Engineer are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, wire or cable. Contractor shall be responsible for, and shall repair all, damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.5 Damage to Existing Facilities.

- (A) Contractor shall repair and/or replace, at no expense to Owner or Facility Agent, any portion of existing structures, roads, utilities, other physical improvements, or natural features within the Project limits damaged by work performed under this Contract or incidental thereto, whether by its own forces, subcontractors, or material suppliers.

02 01 00 – MAINTENANCE OF EXISTING CONDITIONS

- (B) If Contractor observes existing improvements, such as paved roads, that are currently in various states of disrepair or that have pre-existing damage, they shall bring these conditions to the attention of Engineer, and shall make a visual record of such conditions, either by digital photographs or video.

PART 2 – MATERIALS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 02 01 00

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install geotextile fabric as detailed on the Drawings, required by the Technical Specifications or manufacturer's recommendations, or directed by Engineer.

- I.1 Submittals. Contractor shall furnish copies of delivery tickets or other acceptable receipts as evidence of geotextile received and incorporated into construction.
- I.2 Protections. Contractor shall:
 - (A) Accept only specified geotextile fabric. All proposed substitutions must be approved by Engineer in writing prior to purchase.
 - (B) Follow ASTM D4873 for geotextile labeling, shipment, and storage. Product labels shall be color-coded to specifically identify each product and clearly show the Manufacturer's name, style name, and roll number.
 - (C) Wrap each geotextile roll with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants.
 - (D) Geotextile rolls shall be elevated off the ground and adequately covered during storage to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess temperatures, and any other environmental conditions that may damage the physical property values of the geotextile.
- I.3 Quality Assurance
 - (A) Manufacturer Qualifications. The geotextile manufacturer shall have all of the following credentials:
 - i. ISO 9001:2008 Quality Management System
 - ii. GAI - LAP
 - iii. A2LA
 - (B) The geotextile manufacturer shall have a GAI-LAP and A2LA accredited laboratory at the location of production capable of performing the ASTM tests as outlined in the specification.
- I.4 Quality Control
 - (A) Testing shall be performed at an on-site laboratory accredited by GAI-LAP and A2LA for tests required for the geotextile, at frequency meeting or exceeding ASTM D4354.
 - (B) Manufacturer's certifications and testing of quality assurance samples obtained using Procedure B of ASTM D4354. A lot size for conformance or quality assurance sampling shall be considered the shipment quantity of the given product or a truckload of the given product, whichever is smaller.

PART 2 – MATERIALS

- 2.1 Geotextile Fabric Type I shall be nonwoven fabric that conforms to the requirements of KYTC Standard Specifications for Road and Bridge Construction (current edition) Section 843. Approved Manufacturer:

Geotextile Fabric Type I - Mirafi® 180N
TenCate Geosynthetics Americas
365 South Holland Drive, Pendergrass, GA, USA 30567
1-800-685-9990 / 1-706-693-2226
1-706-693-4400 / www.mirafi.com

PART 3 – EXECUTION

- 3.1 Installation. Contractor shall:
- (A) Place geotextiles to the lines and grades shown on the Drawings. At the time of installation, the geotextile shall be rejected by Engineer if it has defects, rips, holes, flaws, evidence of deterioration, or other damage.
 - (B) Place geotextiles smooth and free of excessive wrinkles.
 - (C) When the geotextiles are placed on slopes, lap the upslope fabric portion such that it is the upper or exposed geotextile.
 - (D) Temporarily secure geotextiles in a manner accepted by Engineer prior to placement of overlying materials.
 - (E) Repair or replace any geotextile that is torn or punctured as directed by Engineer by Contractor at no additional cost to Owner. The repair shall consist of a patch of the same type of geotextile placed over the failed areas and shall overlap the existing geotextile a minimum of 12 inches from any point of the rupture.

END OF SECTION 31 05 19

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install coir fabric as detailed on the Drawings, required by the Technical Specifications or manufacturer's recommendations, or directed by Engineer.

- 1.1 Submittals. Contractor shall furnish copies of delivery tickets or other acceptable receipts as evidence of coir fabric received and incorporated into the construction.
- 1.2 Protections. Contractor shall:
 - (A) Accept only specified coir fabric. All proposed substitutions must be approved by Engineer in writing prior to purchase installation.
 - (B) Wrap each coir fabric roll with a material that will protect the coir from damage due to shipment, water, sunlight, and contaminants.
 - (C) Elevate coir fabric rolls off the ground and adequately covered during storage to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess temperatures, and any other environmental conditions that may damage the physical property values of the coir fabric.

PART 2 – MATERIALS

- 2.1 Coir Fabric Type I shall be a semi-permanent (4-6 Year) woven coir matting made from 100 percent biodegradable coconut fiber strands (coir), uniformly twisted and woven into a flexible fabric. Use a fabric of no less than 26.5 ounces per square yard as determined by ASTM D3776 with an open area of no more than 40 percent. The following table provides the minimum properties for Coir Fabric Type I.

Coir Fabric Type I Property	Typical Value
Weight	26.5 oz/SY
Tensile Strength We MD X CD	1260 x 768 lbs/ft
Recommended Velocity	16 fps
Recommended Shear Stress	5 lb/ft ²
Open Area	<40 percent

Approved Manufacturer:

Coir Fabric Type I – Rolanka BioD - Mat 90
Rolanka International, Inc.
155 Andrew Drive, Stockbridge, GA 30281
1-800-760-3215 / 1-770-506-8211
www.rolanka.com

- 2.2 Coir Fabric Type II shall be a semi-permanent (4-6 Year) woven coir matting made from 100 percent biodegradable coconut fiber strands (coir), uniformly twisted and woven into a flexible fabric. Use a fabric of no less than 23 ounces per square yard as determined by ASTM D3776 with an open area of no more than 50 percent. The following table provides the minimum properties for Coir Fabric Type II.

Coir Fabric Type II Property	Typical Value
Weight	23 oz/SY
Tensile Strength We MD X CD	924 x 684 lbs/ft
Recommended Velocity	12 fps
Recommended Shear Stress	4.5 lb/ft ²
Open Area	<50 percent

Approved Manufacturer:

Coir Fabric Type II – Rolanka BioD - Mat 70
Rolanka International, Inc.
155 Andrew Drive, Stockbridge, GA 30281
1-800-760-3215 / 1-770-506-8211
www.rolanka.com

- 2.3 Coir Fabric Type III shall be a durable temporary (12-24 months) mattress coir, stitched between organic nets. Use a fabric of no less than eight and one-half (8.5) ounces per square yard as determined by ASTM D3776. Coir Fabric Type III shall be 100 percent bio-degradable. Photodegradable products will be rejected.

Approved Manufacturer:

Coir Fabric Type III – Rolanka BioD – OCF30
Rolanka International, Inc.
155 Andrew Drive, Stockbridge, GA 30281
1-800-760-3215 / 1-770-506-8211
www.rolanka.com

- 2.4 Coir Fabric Type IV shall be a temporary (6 month) mat woven from spun jute and 100 percent bio-degradable. Photodegradable products will be rejected.

Approved Manufacturer:

Coir Fabric Type IV – Rolanka Jute Mat
Rolanka International, Inc,
155 Andrew Drive, Stockbridge, GA 30281
1-800-760-3215 / 1-770-506-8211
www.rolanka.com

- 2.5 Wooden Stakes. Wooden stakes shall be hardwood, at least 18 inches in length, and with a cross-section of one and a half (1.5) inches by three quarters (0.75) of an inch or larger, with a notch at the top 2" of stake. Substitution of notched stakes with nailed or screwed stakes must be approved by Engineer.
- 2.6 Metal Staples shall not be used.

PART 3 – EXECUTION

- 3.1 Installation. Contractor shall:
- (A) Prepare soil, including grading, topsoil, seed, and mulch. The surface of the soil should be smooth and free of rocks, roots, and other obstructions.
 - (B) Start at the channel toe of slope by anchoring fabric with a six (6) inch fold. Fold the fabric underneath itself and stake using hardwood stakes.
 - (C) Roll the fabric up the slope (recommended for steep slopes) or across the slope. The terminal and top edge of fabric shall be trenched and staked. The middle of the fabric should be staked using hardwood stakes with an appropriate staking pattern for the slope as shown on Drawings. Lay fabric loosely on the ground allowing a good contact between soil and fabrics.
 - (D) When fabric splicing is necessary, use a six (6) inch overlap. Use hardwood stakes to anchor fabric seams. The overlap shall always be with the upstream fabric overlapping the downstream fabric. If overlapping is necessary from top to bottom, the upslope fabric shall overlap the downslope fabric.

END OF SECTION 31 05 20

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to sample and test soil prior to any land disturbance or tree removal as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer. Testing shall be repeated following project completion.

I.1 Restrictions

- (A) Soil sampling and testing shall be performed prior to any tree removal, topsoil stripping, or excavation.
- (B) Soil sampling and testing shall be repeated following project completion.
- (C) Each sampling location shall be representative of a larger general area; more sampling locations shall be added if needed to adequately characterize the site.
- (D) Any areas of disturbance shall have soil and topsoil returned to a condition that is good or better than pre-construction conditions and support establishment of the vegetation specified for the project on the Drawings and in Technical Specifications.

PART 2 – MATERIALS

- 2.1 Tool, such as a soil probe, auger, shovel, or post-hold digger for collecting soil samples for fertility analyses.
- 2.2 A clean plastic bucket (no galvanized or rubber buckets) is needed to collect and mix sample cores, when necessary.
- 2.3 Soil sample boxes or bags for fertility and texture samples are available at all University of Kentucky, College of Agriculture County Cooperative Extension Offices.
- 2.4 Handheld cone penetrometer (mechanical or electronic) with a depth range of at least 18 inches.

PART 3 – EXECUTION

3.1 Soil Sampling and Analysis

- (A) Fertility
 - i. Prior to any tree removal, topsoil stripping, or excavation, Contractor shall collect representative soil samples to document the soil fertility of existing conditions within the areas proposed for disturbance.
 - ii. Soil sampling and analysis of fertility shall be repeated following project construction.
 - iii. Sampling for each stream shall be within the proposed riparian zone and number of samples required shall be one (1) sample per 1,000 feet with a minimum of one (1) sample per stream reach. Each sampling location shall be representative of a larger general area; more sampling locations shall be added if needed to adequately characterize the site.

- iv. Soil sampling methodology for fertility shall be in accordance with University of Kentucky, College of Agriculture County Cooperative Extension Service publication AGR-16, Taking Soil Test Samples.
- v. Soil sampling for fertility shall be to a depth of eight (8) inches.
- vi. Soil samples shall be processed through the University of Kentucky, College of Agriculture Soil Testing Laboratory for fertility analyses. The Routine Soil Test for fertility, or approved equivalent, shall be performed (P, K, pH, buffer pH, Ca, Mg, Zn). Testing forms for submitting samples are available at all University of Kentucky, College of Agriculture County Cooperative Extension Offices.

(B) Texture

- i. Prior to any tree removal, topsoil stripping, or excavation, Contractor shall collect representative soil samples to document the soil texture of existing conditions within the areas proposed for disturbance.
- ii. Soil sampling and analysis of texture shall be repeated following project construction.
- iii. Sampling for each stream shall be within the proposed riparian zone and number of samples required shall be one (1) sample per 1,000 feet with a minimum of one (1) sample per stream reach. Each sampling location shall be representative of a larger general area; more sampling locations shall be added if needed to adequately characterize the site.
- iv. Soil sampling methodology for texture shall be the same as for fertility and shall be in accordance with University of Kentucky, College of Agriculture County Cooperative Extension Service publication AGR-16, Taking Soil Test Samples.
- v. Soil sampling for texture shall be to a depth of eight (8) inches.
- vii. Soil samples shall be processed through the University of Kentucky, College of Agriculture Soil Testing Laboratory for texture analysis (percent sand, silt and clay) and textural classification. Testing forms for submitting samples are available at all University of Kentucky, College of Agriculture County Cooperative Extension Offices.

(C) Compaction

- i. Prior to any tree removal, topsoil stripping, or excavation, Contractor shall perform representative soil sampling of compaction with a handheld cone penetrometer to document the soil compaction of existing conditions within the areas proposed for disturbance.
- ii. Soil sampling of compaction shall be repeated following project construction.
- iii. Sampling for each stream shall be within the proposed riparian zone and number of samples required shall be one (1) sample per 1,000 feet with a minimum of one (1) sample per stream reach. At least two (2) readings shall be taken at each sampling

location. Each sampling location shall be representative of a larger general area; more sampling locations shall be added if needed to adequately characterize the site.

- iv. At least two (2) locations within each proposed staging/stockpiling area shall be sampled. At least two (2) locations along areas planned for traffic during construction, but expected to be returned to forest or pasture land use following construction, shall be sampled. At least two (2) readings shall be taken at each sampling location. Each sampling location shall be representative of a larger general area; more sampling locations shall be added if needed to adequately characterize the site.

3.2 Soil Restoration

(A) Fertility

- i. Any areas of disturbance shall have soil and topsoil returned to conditions of fertility or better than pre-construction conditions and supports establishment of the vegetation specified for the project on the Drawings and in Technical Specifications.
- ii. If required to improve the condition of soil fertility, contractor shall apply lime and/or fertilizer as recommended in University of Kentucky, College of Agriculture County Cooperative Extension Service publication AGR-1, Lime and Nutrient Recommendations.

(B) Texture

- i. Any areas of disturbance shall have soil and topsoil returned to a condition of texture that is good or better than pre-construction conditions and supports establishment of the vegetation specified for the project on the Drawings and in Technical Specifications.
- ii. If required to improve the condition of soil texture, contractor shall add additional topsoil and/or incorporate organic matter such as mulch or compost to improve growing conditions.

(C) Compaction

- i. Any areas of disturbance shall have soil and topsoil returned to a condition of compaction that is good or better than pre-construction conditions and support establishment of the vegetation specified for the project on the Drawings and in Technical Specifications.
- ii. If required to improve the condition of soil compaction (decrease soil compaction), disc, rip, or otherwise mechanically break up soil. Avoid working soil when it is too wet or too dry.
- iii. Organic matter such as mulch or compost can be worked into the soil to improve surface compaction.

END OF SECTION 31 09 00

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to selectively clear trees and shrubs necessary for the execution of work within the limits of the Project site as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

I.1 Restrictions

- (A) Contractor shall only remove trees and shrubs that are absolutely necessary for the execution of the work and shall make all efforts to minimize tree removal unless otherwise shown on the Drawings.
- (B) Trees not required for reuse as in-stream, bank, or floodplain structures shall be stockpiled as indicated by the Facility Agent, chipped for use as mulch within the riparian/easement area, or placed within easement areas as woody debris or woody habitat piles per Engineer and Owner.

- I.2 Protections. Trees shall be removed in a manner to allow them to be reused on the site as in in-stream, bank, or floodplain structures or items requiring the use of wood.

PART 2 – MATERIALS (NOT APPLICABLE)

PART 3 – EXECUTION

Contractor shall:

- 3.1 Remove stumps, shrubs, and rubbish in all areas to receive more than one (1) foot of fill or to be excavated more than one (1) foot. If approved by Engineer, some trees may be left in areas of fill to minimize site disturbance and overgrading.
- 3.2 Strip all areas of all vegetation, topsoil, and other organic material as specified in Section 31 14 13.
- 3.3 Temporarily stockpile all material grubbed or stripped for use as final dressing of the site.

END OF SECTION 31 13 13

PART 1 – GENERAL

Contractor shall furnish all materials, equipment, and labor required to strip, load, haul, stockpile, place, spread, and roll topsoil material as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

1.1 Restrictions

- (A) Contractor shall stockpile all cleared topsoil material and use for final dressing. Locate topsoil stockpiles so that the material can be used readily for the finished grading.
- (B) Do not excavate topsoil that is saturated enough to become structurally unstable.
- (C) Where sufficient existing topsoil that conforms to the material requirements is not available on site, Contractor shall provide borrow materials suitable for use as topsoil.
- (D) Material excavated that is unsuitable for use as topsoil or backfill, or is in excess of required fill, shall be properly disposed of off-site or graded appropriately on adjacent property as approved by the Facility Agent and Engineer. See also Section 31 22 13.

- 1.2 Protections. Contractor shall protect topsoil and keep in segregated piles until needed. Protect all topsoil stockpiles from sediment transport as specified in Section 01 57 13.

PART 2 – MATERIALS

- 2.1 Topsoil is the uppermost layer of soil capable of growing and supporting vegetation.
- 2.2 Topsoil material shall be free of heavy clay, refuse, stumps and large roots, rocks over two (2) inches in diameter, brush, weeds and weed seeds, or other material which would be detrimental to the proper development of vegetative growth. Leaf litter can be included in topsoil material.

PART 3 – EXECUTION

3.1 Topsoil

- (A) Prior to beginning rough grading (Section 31 22 13), excavate topsoil within the limits of the Project to a minimum depth of six (6) inches (if available) and salvage in designated stockpile locations on Drawings or as designated by Owner in a manner that will facilitate measurement, minimize sediment damage, and not obstruct natural drainage
- (B) Imported topsoil shall be hauled to the site and stockpiled in locations designated by Owner, only after prior approval by Engineer.
- (C) No soil stockpile shall exceed eight (8) feet in height.
- (D) Any topsoil stockpile remaining longer than 30 days shall be protected as specified in Section 01 57 13.
- (E) Use all cleared topsoil material for final dressing as specified in Section 31 22 19.

31 14 13 – TOPSOIL STRIPPING AND STOCKPILING

- 3.2 Inspection. Engineer shall visually approve representative samples of topsoil. All operations involved in the placing, spreading, and rolling of the topsoil shall be subject to the approval of Owner. Selected topsoil shall be obtained from approved stockpiles of materials from excavation, from stripping, from borrow areas, or from other approved sources.

END OF SECTION 31 14 13

31 14 18 – NATIVE CHANNEL MATERIAL STRIPPING AND STOCKPILING

PART 1 – GENERAL

Contractor shall furnish all materials, equipment, and labor required to strip, load, haul, stockpile, place, and spread native channel material as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

- 1.1 Restrictions. Native channel material shall be stockpiled and used for final dressing in the new channel construction or graded channel beds. Locate stockpiles so that the material can be used readily for the finished grading.
- 1.2 Protections. Contractor shall protect native channel material and keep in segregated piles until needed.

PART 2 – MATERIALS

- 2.1 Native Channel Material. Native channel material shall be comprised of the natural cobble, gravel, and sand material located within the existing stream channel bed.

PART 3 – EXECUTION

Contractor shall:

- 3.1 Excavate and remove native channel material from within the limits defined on the Drawings.
- 3.2 Stockpile native channel material in designated stockpile locations on Drawings or as designated by Engineer in a manner that will minimize site impacts and not obstruct natural drainage
- 3.3 Maintain stockpiles in a neat, well-shaped state capable of shedding water.

END OF SECTION 31 14 18

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to grade, shape, and compact the subgrade to the required elevations and dimensions as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

I.1 Restrictions

- (A) Contractor shall clear limits of working areas in a manner to enable satisfactory restoration and not affect the environment during or after the construction period. Contractor shall not enter beyond the working limits of the working area except with written approval of Engineer and Owner.
- (B) All excavation will be considered unclassified.

I.2 Protections. Contractor shall:

- (A) Protect trees and other features remaining as portion of final landscaping.
- (B) Prevent damage to existing fencing, trees, landscaping, natural features, benchmarks, specialized land uses (i.e. pasture, park, golf course), travel pathways/corridors, utility lines, and other features not designated for demolition. Correct damage at no cost to Owner.
- (C) Protect above or below grade utilities which are to remain.
- (D) Be responsible for repairing any damage to those items not designated for demolition or removal in a manner satisfactory to Owner at no additional cost to Owner.
- (E) Protect the subgrade and repair all damage.
- (F) Use equipment with low impact tires when hauling materials over the completed subgrade. Do not operate equipment of such weight as to cause rutting on the subgrade.
- (G) Not store or stockpile materials on a completed subgrade.

PART 2 – MATERIALS

- 2.1 Suitable soil material excavated during rough grading shall be stockpiled and used as fill for the existing channel, backfilling, and bank restoration as indicated on the Drawings. Fill shall be as specified in Section 31 23 23.
- 2.2 Excavation for rough grading is unclassified and requires excavation of materials encountered, including surface boulders, masonry, organics, rocks, and miscellaneous debris, to create and shape the floodplain and stream features as indicated on the Drawings.

PART 3 – EXECUTION

3.1 Contractor shall:

- (A) Excavate subsoil in accordance with lines and levels established for the work, including adequate space to allow installation of materials and inspection. Any stockpiling of materials

or “double handling” necessary to build the restoration Project shall be considered incidental to construction.

- (B) Perform additional excavation only by Engineer’s written authorization.
- (C) Excavate by mechanical means. No blasting will be permitted. Any property damage caused by rock excavation operations shall be the responsibility of Contractor. Excavation shall be shaped and graded as shown on the Drawings.
- (D) Maintain a well-drained embankment and excavation operation to avoid ponding of water and softened material.
- (E) Excavate topsoil from areas to be excavated and stockpile as specified in Section 31 14 13.
- (F) Excavate subsoil from indicated areas and stockpile in area designated on site. If material is Native Channel Material, stockpile as specified in Section 31 14 18.
- (G) Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered shall be removed as directed by Owner or Engineer. Refill excavations below indicated depth with satisfactory material and compact as specified by Owner or Engineer.
- (H) Stockpile subsoil to a height not exceeding eight (8) feet.
- (I) Cut roots with a sharp axe, when excavation through roots is necessary.

3.2 Underground Utilities

- (A) Locations of underground utilities and sewer lines are not shown on the Drawings but may be present in the Project area.
- (B) Contractor is responsible for anticipating underground obstructions, and no extra payment will be allowed for removal, replacement, repair, or possible increased cost caused by underground obstructions except upon agreement of Owner.
- (C) Contractor shall identify underground utilities as directed in the Section 02 01 00.
- (D) Responsibility for damage or claims for damage caused by construction to any underground structure shall be assumed by Contractor.
- (E) Upon discovery of unknown utility or concealed conditions, Contractor shall discontinue affected work; notify Engineer.

3.3 Rough grading has no tolerance. It is the responsibility of Contractor to account for fill, excavation, riffle material, structures, native channel fill, topsoil or other final level lines and grades.

END OF SECTION 31 22 13

PART 1 – GENERAL

Contractor shall furnish all materials, equipment, and labor required shape, trim, and finish disturbed areas including, but not limited to, floodplains, slopes, and stream channels as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

1.1 Restrictions.

- (A) All cleared topsoil material shall be stockpiled and use for final dressing. Locate topsoil stockpiles so that the material can be used readily for the finished grading.
- (B) Where sufficient existing topsoil that conforms to the material requirements is not available on site, Contractor shall provide borrow materials suitable for use as topsoil.
- (C) Topsoil shall only be used in a relatively dry state during dry weather.

1.2 Protections. Contractor shall prevent damage to existing fencing, trees, landscaping, natural features, benchmarks, specialized land uses (i.e. pasture, park, golf course), travel pathways/corridors, and utility lines. Correct damage at no cost to Owner.

PART 2 – MATERIALS

2.1 Topsoil. Topsoil shall meet the requirements of Section 31 14 13.

2.2 Wetland Topsoil. All wetland material shall consist of moist organic soil, including any existing wetland vegetation and seeds. All wetland topsoil materials shall meet the requirements of Section 31 14 13.

PART 3 – EXECUTION

3.1 Installation. Contractor shall:

- (A) Following the installation of in-stream structures, stream channel and floodplains shall be final graded to provide a smooth transition around the structures and between proposed and existing slopes.
- (B) Contractor shall finish the entire disturbed area to the lines and grades shown on the Drawings, and blend into the existing adjacent grade. Upon completion, the disturbed area shall be free of deep ruts and other irregularities but shall not be overly compacted.
- (C) Topsoil shall be placed on all excavated areas. Maintain levels, profiles, and contours of subgrades.

3.2 Tolerances. Finished graded surfaces should be true to grades shown on the Drawings, with a maximum vertical tolerance of two-tenths of one foot (0.2) on channel work and one-half foot (0.5) on floodplain earthwork.

END OF SECTION 31 22 19

PART 1 – GENERAL

Contractor shall furnish all materials, equipment, and labor required deposit, place, and compact earth of acceptable quality above or below the natural ground, existing stream channel fill, or other surface to elevations and dimensions detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

- 1.1 Restrictions. Limits of working areas shall be cleared in a manner which will enable satisfactory restoration and will not affect the environment during or after the construction period. Contractor shall not enter beyond the working limits of the working area except with written approval of Engineer and Owner.
- 1.2 Protections. Contractor shall:
 - (A) Protect trees and other features remaining as portion of final landscaping.
 - (B) Prevent damage to existing fencing, trees, landscaping, natural features, benchmarks, specialized land uses (i.e. pasture, park, golf course), travel pathways/corridors, utility lines, and other features not designated for demolition. Correct damage at no cost to Owner.
 - (C) Protect above or below grade utilities which are to remain.
 - (D) Be responsible for repairing any damage to those items not designated for demolition or removal in a manner satisfactory to Owner at no additional cost to Owner.
 - (E) Protect the subgrade. Repair all damage and restore the subgrade to the required template.
 - (F) When hauling materials over the completed subgrade, use equipment with pneumatic tires. Do not operate equipment of such weight as to cause rutting on the subgrade.

PART 2 – MATERIALS

- 2.1 All fill material shall be obtained from required excavations and approved borrow areas. The selection, blending, routing, and disposition of material in the various fills shall be subject to approval by Engineer.
- 2.2 Fill used in areas of existing streams must contain clay and be approved by Engineer.

PART 3 – EXECUTION

- 3.1 Installation. Contractor shall:
 - (A) Fill and backfill to lines, grades, and dimensions indicated on the Drawings.
 - (B) Not place fill over frozen or wet areas.
 - (C) Compact the subgrade of fill areas of existing streams using a bulldozer, track excavator, or other approved equipment before placing fill.
 - (D) Place fill in horizontal lifts extending the full width and length of embankments.

- (E) Do not mass dump material into the final position.
 - (F) Distribute the fill uniformly, preventing the development of voids, pockets, or poorly mixed material.
 - (G) Apply water to the material if necessary to achieve compaction.
 - (H) Compact fill in areas of existing streams using sheep foot rollers, pad foot rollers, tamping foot rollers, pneumatic tire rollers, steel wheel rollers, vibratory plates, vibratory rollers, or other approved equipment. Areas not accessible to rollers or compactors shall be compacted with hand tampers.
 - (I) Each lift shall not be more than one foot (1) in height, unless otherwise noted in Drawings.
 - (J) Compact each lift before placing overlying lift.
 - (K) Finish to a smooth surface by blading or rolling.
 - (L) Compact each lift with no less than four (4) passes with approved equipment.
- 3.2 Tolerances. Following compaction, fill material should be fine graded smooth and true to grades shown on the Drawings, with a maximum tolerance of two-tenths of one foot (0.2). See also Section 31 22 19.

END OF SECTION 31 23 23

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to plant seed mixes as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

I.1 Submittals.

- (A) Prior to commencement of the work, Contractor shall submit to Engineer a complete materials list of items proposed for the work and identify sources for the materials. This list must be accompanied by the geographic location of the seed source (within USDA Hardiness Zone 6) and the seed test tag with respect to the supplier's guaranteed analysis for percentages of seeds in mixture, seed purity (PLS), germination, weed seed content, and inert material content.
- (B) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence plant seed mixes received and planted.

I.2 Restrictions

- (A) All proposed seed substitutions or changes in percent composition of seed must be approved by Engineer in writing prior to purchase and planting.
- (B) Contractor shall seed the newly constructed stream banks and floodplains as soon as possible.
- (C) The following seasonal considerations may improve success of native species establishment.
 - i. November 1 thru February 28. Seeding during this time should be protected from displacement due to water and wind erosion. Seeding on bare, graded surfaces must be protected with appropriate erosion control blankets and with straw mulch at one and one-half (1.5) tons per acre.
 - ii. March 1 thru June 29. Seeding during this period is appropriate but germination of a portion of the seed may not occur until the following season due to lack of cold stratification to break seed dormancy. Seeding on bare, graded surfaces must be protected with appropriate erosion control blankets and with straw mulch at one and one-half (1.5) tons per acre.
 - iii. June 30 thru August 30. Installation of native seed mix should be suspended unless watering can be provided and if approved in writing by Engineer.
 - iv. September 1 thru October 31. Seeding on graded, bare-soil surfaces must be protected with appropriate erosion control blankets and with straw mulch at one and one-half (1.5) tons per acre.
- (D) Seeding operations should not occur if the soil is wet and muddy and should be postponed until soil moisture is appropriate for the seeding operation. No seeding shall be done during windy weather or when ground is wet, frozen, or otherwise non-tillable.

- (E) These are general guidelines and may be modified. It is the sole responsibility of Contractor to establish vegetation within the warranty period

1.3 Protections. Contractor shall:

- (A) Ensure seed is not delivered until the Project site has been prepared for planting. All seed shall be shipped in the original, sealed container with the label information intact and legible.
- (B) Keep seed in its original container with the label information intact and legible. The seed shall be stored away from moisture, excessive heat, and direct sunlight. The seed shall be protected from rodents, insects, and other vermin.
- (C) Repair any damage caused to the seeded areas by Contractor's operations at the expense of Contractor.

1.4 Warranty

Contractor shall warrant all work for a period of two (2) years following Final Completion of work as specified in the General Conditions. In addition, Contractor shall further warrant the establishment and survival of vegetation, trees and shrubs as specified below.

- (A) The initial warranty period shall begin after Engineer's inspection and acceptance of the installation of seed and extend through two (2) years from the date of Final Completion.
- (B) Owner will monitor the Project annually following Final Completion. Contractor shall be responsible for re-seeding all areas which, in the opinion of Owner, experience a survival rate of less than 85 percent aerial coverage per 1,000 square foot area.
- (C) Re-seeding shall be conducted as directed by Owner and in accordance with the Drawings and Technical Specifications.
- (D) Should re-seeding be required, Contractor shall provide a subsequent care and replacement warranty to begin upon Engineer's inspection and acceptance of the re-seeding effort and extend through two (2) years from that date.
- (E) Contractor shall not be responsible for damage or mortality to seeded areas due to vandalism, fire, prolonged flooding, or other activities deemed by Owner to be beyond Contractor's control.

PART 2 – MATERIALS

2.1 Seed. Seed and seed mixtures shall be as specified on the Drawings.

- (A) The seed supplier of the permanent seed mixture shall be approved Engineer in writing. The seed supplier shall certify that the seed was produced from USDA Hardiness Zone 6 and written certification shall be provided to Engineer upon request. Seed collected from "the wild" is prohibited.
- (B) The seed mix shall be clean and free of weeds.

- (C) All seed shall be labeled in accordance with state laws and the USDA Rules and Regulations under the Federal Seed Act.
 - (D) The mixing of seed may be done by the seed supplier or on site as directed.
 - (E) Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.
- 2.2 Temporary Seed. Temporary seed mix species, application rates, and application techniques for erosion control shall be as specified on the Drawings; see also Section 01 57 13. Temporary pure live seed shall be a minimum of 95 percent by weight of the total volume.
- 2.3 Permanent Native Seed. Permanent seed mix species, application rates, and application techniques shall be as specified on the Drawings. Permanent native pure live seed shall be a minimum of 99 percent by weight of the total volume.
- 2.4 Straw Mulch. Straw mulch for this item shall be small-grain straw free of weeds, disease, and rot. Straw mulch obtained from regular farming operations is not free of weeds and will be rejected.

PART 3 – EXECUTION

- 3.1 Seed Bed. Contractor shall:
- (A) Till applied topsoil in areas that are to be seeded to a minimum depth of three (3) inches. To avoid soil compaction, equipment access and travel should be routed around all planting areas, and repeat passes over the same area should be limited during all grading, topsoil application, and de-compaction work. Equipment having low unit pressure ground contact should be utilized whenever possible.
 - (B) The seedbed should be well prepared and free of clods greater than three (3) inches in diameter. If crusting from rainfall has occurred, re-scarification is required.
- 3.2 Installation. Contractor shall:
- (A) Seed and mulch all non-paved disturbed areas within the Project area as specified on the Drawings unless otherwise directed by Engineer. Seed species and application rates are noted on the Drawings.
 - (B) Install erosion control blanket (coir fabric) over seed and mulch as indicated on the Drawings. See also Section 31 05 20.
 - (C) Accomplish seeding by hand or using a broadcast spreader. Any alternative methods of seeding must be approved by Engineer in writing.
 - (D) Broadcast temporary and permanent native seeds at rates specified on the Drawings.
 - (E) Maximize the seed/soil contact by firming soil around the seed with a cultipacker or by dragging the surface with a finish harrow chain link fence.

- (F) Apply straw mulch at one and one-half (1.5) tons per acre. The soil should be visible through the straw. To prevent straw from blowing away, it should be dampened or covered with erosion control fabric, as specified.
 - (G) Fertilizers or soil conditioners shall be approved by Engineer in writing.
- 3.3 Maintenance. Control aggressive / invasive plant species by means of mowing, hand pulling, and/or herbicide applications as required. Utilize licensed applicators who are experienced with native and non-native plant identification to perform herbicide treatments who are experienced with native and non-native plant identification. Use herbicides in full conformation with label imitations and limit overspray and damage to off-target species.

END OF SECTION 32 92 19

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install tree seed mixes as detailed on the Drawings, required by the Technical Specifications, or directed by the Engineer.

I.1 Submittals.

- (A) Prior to commencement of the work, Contractor shall submit to Engineer a complete materials list of items proposed for the work and identify sources for the materials. This list must be accompanied by the geographic location of the seed source (within USDA Hardiness Zone 6) and the seed test tag with respect to the supplier's guaranteed analysis for percentages of seeds in mixture, seed purity (PLS), germination, weed seed content, and inert material content.
- (B) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence plant seed mixes received and planted.

I.2 Restrictions

- (A) All proposed seed substitutions or changes in percent composition of seed must be approved by Engineer in writing prior to purchase and planting.
- (B) Contractor shall seed the newly constructed stream banks and floodplains as soon as possible.
- (C) The following seasonal considerations may improve success of native species establishment.
 - i. Refer to planting plan in the Drawings to identify tree seed that require cold stratification before planting. Most tree seed in the seed mixture must be cold stratified (chilled/refrigerated at 2 to 5 degrees Celsius) for a period of 28 to 90 days if planted between mid-January to August. Tree seed chilling temperatures and number of cold period days for each species are specified in *The Woody Plant Seed Manual* published by the U.S. Forest Service (USDA 2008) or as recommended by the seed supplier. Seed that requires cold stratification may be applied between September and mid-January without prior chilling.
 - ii. November 1 thru February 28. Seeding during this time should be protected from displacement due to water and wind erosion. Seeding on bare, graded surfaces must be protected with straw mulch at one and one-half (1.5) tons per acre.
 - iii. March 1 thru June 29. Seeding during this period is appropriate but germination of a portion of the seed may not occur until the following season due to lack of cold stratification to break seed dormancy. Seeding on bare, graded surfaces must be protected with straw mulch at one and one-half (1.5) tons per acre.
 - iv. June 30 thru August 30. Installation of native seed mix should be suspended unless watering can be provided and if approved in writing by Engineer.
 - v. September 1 thru October 31. Seeding on graded, bare-soil surfaces must be protected with straw mulch at one and one-half (1.5) tons per acre.

- vi. These are general guidelines only and may be modified. It is the sole responsibility of Contractor to establish vegetation within the tree establishment and warranty periods.

- (D) Hydro-Seeding operations should not occur before rain events are predicted to have more than 1 inch of precipitation. Following rain events, seeding operations should be postponed until soil moisture is appropriate for the seeding operation. No seeding shall be done during windy weather or when ground is frozen or otherwise non-tillable.

1.3 Protections. Contractor shall:

- (A) Ensure seed is not delivered until the Project site has been prepared for planting. All seed shall be shipped in the original, sealed container with the label information intact and legible.
- (B) Keep seed in its original container with the label information intact and legible. The seed shall be stored away from moisture, excessive heat, and direct sunlight. The seed shall be protected from rodents, insects, and other vermin.
- (C) Repair any damage caused to the seeded areas by Contractor's operations at the expense of Contractor.
- (D) A period of care and replacement shall begin after inspection of the initial seeding of all areas as specified in the Special Conditions.
- (E) Only operate trucks used from hydroseeding from roads, bridges, or reasonably level areas where slopes are stable and risks of rollover are insignificant.

PART 2 – MATERIALS

2.1 Tree Seed. Tree seed and trees seed mixtures shall be as specified on the Drawings.

- (A) The tree seed supplier of the permanent seed mixture shall be approved Engineer in writing. The seed supplier shall certify that the seed was produced from USDA Hardiness Zone 6 and written certification shall be provided to Engineer upon request. Seed collected from "the wild" is prohibited.
- (B) The tree seed mix shall be clean and free of weeds.
- (C) All tree seed shall be labeled in accordance with state laws and the USDA Rules and Regulations under the Federal Seed Act.
- (D) The mixing of tree seed may be done by the seed supplier or on site as directed.
- (E) Tree seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

2.2 Tree Seed. Tree seed mix species, application rates, and application techniques shall be as specified on the Drawings. Pure live seed shall be a minimum of 99 percent by weight of the total volume.

2.3 Straw Mulch. Straw mulch for this item shall be small-grain straw free of weeds, disease, and rot. Straw mulch obtained from regular farming operations is not free of weeds and will be rejected.

- 2.4 Wood Fiber Mulch. If hydroseeding is used for temporary or permanent native seed, wood fiber mulch shall be applied at a rate of 1,750 pounds per acre. Dyed wood fiber mulch must be approved by the Engineer in writing.
- 2.5 Tackifiers. Hydroseeding tackifiers must be approved by the Engineer in writing. If approved by the Engineer, tackifiers shall be applied at 100 pounds of dry ingredient per acre.
- 2.6 Fertilizers. Fertilizers, used for any seed application method, must be approved by the Engineer in writing.
- 2.7 Tank-Mounted Truck. Tank-Mounted Truck must be equipped with a pump and continuous agitation system.
 - (A) Pump shall be specialized for the purposes of hydroseeding, being capable to force the slurry through a hose and nozzle.
 - (B) Tank size shall have at least a storage capacity of 1,000 gallons and shall not have a storage capacity of more than 3,000 gallons.

PART 3 – EXECUTION

- 3.1 Seed Bed. Contractor shall:
 - (A) Till applied topsoil in areas that are to be seeded to a minimum depth of three (3) inches. To avoid soil compaction, equipment access and travel should be routed around all planting areas, and repeat passes over the same area should be limited during all grading, topsoil application, and de-compaction work. Equipment having low unit pressure ground contact should be utilized whenever possible.
 - (B) The seedbed should be well prepared and free of clods greater than three (3) inches in diameter. If crusting from rainfall has occurred, re-scarification is required.
- 3.2 Installation. Contractor shall:
 - (A) Seed and mulch all non-paved disturbed areas within the Project area as specified on the Drawings unless otherwise directed by Engineer. Seed species and application rates are noted on the Drawings.
 - (B) Refer to planting plan in the Drawings to identify tree seed that require cold stratification before planting. Most tree seed in the seed mixture must be cold stratified (chilled/refrigerated at 2 to 5 degrees Celsius) for a period of 28 to 90 days if planted between mid-January to August. Tree seed chilling temperatures and number of cold period days for each species are specified in The Woody Plant Seed Manual published by the U.S. Forest Service (USDA 2008) or as recommended by the seed supplier. Seed that requires cold stratification may be applied between September and mid-January without prior chilling.
 - (C) For hydroseeding, the ratio of water, seed, mulch, and admixtures critical for hydro seeding success must follow seed supplier recommendations based on the seed mixture specified on the Drawings.

- (D) For hydroseeding slurry, water is added to the truck-mounted slurry tank first. Following the addition of the water, wood fiber, tackifier (if approved), fertilizer (if approved), and seed mix is added to the tank in that order. Seed should not be added to the slurry tank until immediately prior to the hydroseeding application and shall not remain in the tank for more than 30 minutes.
 - (E) If hydroseeding is used, application rates as indicated on the Drawings should be doubled.
 - (F) Apply straw mulch at one and one-half (1.5) tons per acre. The soil should be visible through the straw. To prevent straw from blowing away, it should be dampened or covered with erosion control fabric, as specified.
 - (G) Fertilizers, soil conditioners, or tackifiers shall be approved by Engineer in writing.
- 3.3 Maintenance. Control aggressive / invasive plant species by means of mowing, hand pulling, and/or herbicide applications as required. Utilize licensed applicators who are experienced with native and non-native plant identification to perform herbicide treatments who are experienced with native and non-native plant identification. Use herbicides in full conformation with label imitations and limit overspray and damage to off-target species.

END OF SECTION 32 92 20

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to plant live stakes as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

I.1 Submittals.

- (A) Prior to the commencement of work, Contractor shall submit to Engineer a complete materials list of items proposed for the work and identify sources for materials.
- (B) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence of live stakes received and planted.

I.2 Restrictions

- (A) Contractor shall provide Engineer notice of delivery of live stakes at least 10 calendar days in advance. All proposed species substitutions or changes must be approved by Engineer in writing prior to purchase and planting. Only specified species will be accepted. Cultivated varieties (cultivars) will be rejected.
- (B) Live stakes should be installed at any time during their dormant period when the ground is not frozen. Do not install live stakes after dormancy is broken or after sprouting. Stakes that begin sprouting before planting will be rejected.
- (C) Live stakes shall be soaked for 24 hours prior to installation in clear water, with the basal end of the plant in the water and remove from the water no more than one (1) hour before planting.
- (D) Live stakes shall not be soaked for greater than three (3) days.
- (E) These are general guidelines and may be modified. It is the sole responsibility of Contractor to establish plantings within the warranty period.

I.3 Protections. Contractor shall:

- (A) Inspect live stakes in conjunction with Engineer upon delivery to the Project site for conformity to species and quality.
- (B) Identify nursery stock material with attached, durable, waterproof labels and weatherproof ink. Labels shall state the scientific name of the specified plants. Common names are not acceptable. The scientific names must match those on the Drawings. Plants that are unlabeled or improperly labeled shall not be accepted.
- (C) Reject plants showing desiccation, abrasion, sun-scald injury, disfigurement, or unauthorized substitution.
- (D) Store and protect plants not installed on the day of arrival in a continuously cool, covered, and moist state in an area approved by Engineer.
- (E) Protect live stakes from freezing when air temperatures are 32 degrees Fahrenheit or below.

- (F) Repair any damage caused to the planted areas by Contractor's operations at the expense of Contractor.

1.4 Warranty

Contractor shall warrant all work for a period of two (2) years following Final Completion of work as specified in the General Conditions. In addition, Contractor shall further warrant the establishment and survival of vegetation, trees and shrubs as specified below.

- (A) The initial warranty period shall begin after Engineer's inspection and acceptance of the installation of live stakes and extend through two (2) years from the date of Final Completion.
- (B) Owner will monitor the Project annually following Final Completion. Contractor shall be responsible for re-planting all live stakes which, in the opinion of Owner, experience a survival rate of less than 90 percent.
- (C) Re-planting of live stakes shall be conducted as directed by Engineer and in accordance with the Drawings and Technical Specifications.
- (D) Should re-planting of live stakes be required, Contractor shall provide a subsequent care and replacement warranty to begin upon Engineer's inspection and acceptance of the re-planting effort and extend through two (2) years from that date.
- (E) Contractor shall not be responsible for damage or mortality to live stakes due to vandalism, fire, prolonged flooding, or other activities deemed by Owner to be beyond Contractor's control.

PART 2 – MATERIALS

- 2.1 Stakes shall be one-half of one (0.5) inch to three (3) inches in diameter and three (3) to four (4) feet in length.
- 2.2 Live stake plant species and quantities shall be in accordance with the Drawings.
- 2.3 Cuttings shall be alive, but dormant, with side branches removed and bark intact.
- 2.4 The live stakes should be relatively straight with no visible signs of disease, damage, or deformity.
- 2.5 The bottom or basal end of the cutting should be cleanly cut at a 45 degree or sharper angle and the top end should be cut square (flat).

PART 3 – EXECUTION

- 3.1 Installation. Contractor shall:
 - (A) Drive live stakes through the erosion control fabric and into the ground so that three quarters (3/4) of the stake is below the ground surface. Contractor shall use a dead-pan hammer for driving the stake directly into the ground or drive a pilot hole, smaller in diameter than the live stake, and then driving the live stake into the pilot hole.

- (B) Stagger the live stakes in a random pattern throughout the specified planting area at the density specified by the Drawings.
- (C) Install live stakes above the low flow water surface and below bankfull elevation as indicated on Drawings.
- (D) Each live stake shall be positioned perpendicular to the slope at a 90-degree angle followed by foot compaction around each cutting.
- (E) All live stakes split during installation may be left in place but must be supplemented with a new live stake that remains un-split after installation. Live stakes that become split or “mushroomed” during installation shall be replaced at Contractor’s expense.

3.2 Maintenance

Maintenance of live stakes shall include watering, control of aggressive / invasive species, and removing and replacing unhealthy plants. Contractor shall:

- (A) Water plant material as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of one (1) inch of absorbed water per week, delivered in the form of rain or augmented by watering. Runoff, puddling, and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or existing plant material shall be prevented.
- (B) Control aggressive / invasive plant species by means of mowing, hand pulling, and/or herbicide applications as required. Utilize licensed applicators who are experienced with native and non-native plant identification to perform herbicide treatments who are experienced with native and non-native plant identification. Use herbicides in full conformation with label limitations and limit overspray and damage to off-target species.

END OF SECTION 32 93 10

PART I - GENERAL

Contractor shall furnish all materials, equipment, and labor required to plant trees as detailed on the Drawings, required by the Technical Specifications, or directed by the Engineer.

I.1 Submittals.

- (A) Prior to commencement of work, Contractor shall submit to Engineer a complete materials list of items proposed for the work and identify sources for materials.
- (B) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence of trees received and planted.

I.2 Restrictions.

- (A) Contractor shall provide Engineer notice of delivery of trees at least 10 calendar days in advance. All proposed species substitutions or changes in percent composition of species must be approved by Engineer in writing prior to purchase and planting. Only specified species will be accepted. Cultivated varieties (cultivars) will be rejected.
- (B) Trees that have evidence of stress, disease, dieback, or mishandling shall be rejected. Trees damaged in handling or transportation may be rejected by Engineer. Trees collected from "the wild" shall be rejected.
- (C) Planting should occur during the dormant season, which occurs after hardwoods have lost their leaves in the fall and before they begin to grow in the spring (generally October through May). Ideally, trees would be planted between March 1 to May 31 for spring establishment, and from October 1 to November 1 for fall establishment, when beneficial results can be obtained. Proposed planting times shall be submitted to Engineer for approval.
- (D) Work shall be stopped when drought, excessive moisture, frozen ground, or other unsatisfactory conditions prevail. When the conditions warrant a variance to the planting operations, proposed planting times shall be submitted for approval by Engineer.

I.3 Protections. Contractor shall:

- (A) Protect trees during delivery to prevent desiccation and damage to the branches, trunk, or root system.
- (B) Not store trees longer than 30 days. If trees are not planted on the day of delivery, they shall be stored onsite in a shaded location and kept cool and moist. Trees shall be protected from direct exposure to excessive wind and sun.
- (C) Inspect trees upon delivery for conformity to species and quality. Trees shall be well shaped, vigorous and healthy with a well-branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement, abrasion, mishandling, or poor pruning. Trees shall be inspected for unauthorized substitution and to certify nursery-grown status.
- (D) Identify nursery stock material with attached, durable, waterproof labels and weatherproof ink. Labels shall state the scientific name of the specified plants. Common names are not

acceptable. The scientific names must match those on the Drawings. Plants that are unlabeled or improperly labeled shall not be accepted.

- (E) Reject trees showing desiccation, abrasion, sun-scald injury, disfigurement, or unauthorized substitution. If bark slips off easily, cambium layer has turned brown, mold is present, roots are dry, and/or trees are hot to touch, the trees should be rejected.
- (F) Protect trees from freezing when air temperatures are 32 °F or below.
- (G) Trees shall receive mulch in the form of hardwood mulch or mulch mats shall be used.
- (H) A period of care and replacement shall begin after inspection of the initial installation of all trees as specified in the Special Conditions.

PART 2 – MATERIALS

- 2.1 Tree species and quantities shall be in accordance with those on the Drawings.
- 2.2 Unless approved by the Engineer in writing, all trees must come in #3 containers, or larger. #3 containers have an 11-inch top diameter with a depth of 7 5/8 inches. Plant stock shall be healthy representatives typical of their species or variety, be free of damage and disease, and exhibit a normal habit of growth.
- 2.3 Trees collected from “the wild” are prohibited.
- 2.4 Tree Protectors. If tree protectors are used, tree protectors shall be vented, translucent, and 24 to 48 inches high. Tree protectors shall be installed around each planted tree per manufacturer’s recommendation. Tree protector purchase and installation is at the discretion of Contractor.
- 2.5 Hardwood Mulch. Double shredded hardwood mulch shall consist of the bark from hardwood trees which has been milled and screened to a maximum four (4) inch particle size.
- 2.6 Mulch shall provide a uniform texture free from sawdust, weed seeds, foreign materials and any artificially introduced chemical compounds detrimental to plant life.
- 2.7 Mulch Mats. Mulch mats shall be a four-tenths of one (0.4) inch thick needle-punched mattress coir pad with a weight of two and six-tenths (2.6) pounds per square yard (lbs/SY).

PART 3 – EXECUTION

- 3.1 Site Preparation. The site must be finally graded and stabilized as indicated on the Drawings or by Engineer. Planting zone limits shall be staked on the Project site before planting occurs.
- 3.2 Installation. Contractor shall install trees in a hole drilled with an auger or made with a shovel.
 - (A) Planting holes shall be excavated so that the top of the root ball is equal to or slightly higher than the surrounding soil surface, so that the root ball is resting on solid, undisturbed soil to avoid sinkage. The width of the hole shall be at least two (2) times the width of the root ball.
 - (B) If the depth of the hole is dug too deep, add soil back to the hole and compact with foot to desired depth.

- (C) Root balls should remain in the container until placed in the hole. Lay the tree on its side and tap the container sides to loosen root ball. Remove container. Gently separate roots and guide them outward. Cut off long or crooked roots, and if roots are spiraling inside the container, cut side of root ball in 2 or 3 places or untangle spiraling before placing in hole.
 - (D) Ensure that tree remains straight while backfilling and firming the soil to close hole, being careful to eliminate large air pockets/voids. Break up clumps for soil used in backfilling. Compact the soil lightly as the hole is backfilled.
 - (E) Water trees thoroughly immediately after planting until saturated.
 - (F) To reduce soil water loss, regulate soil temperature, and prevent weed growth, spread mulch to cover a 12-inch radius with a minimum three (3)-inch uniform thickness or install mulch mat. Apply mulch or mulch mat within 48 hours after planting.
- 3.3 Maintenance. Maintenance of plant material shall include straightening plant material, supplementing mulch, pruning dead / broken branch tips, watering, weed control, and removing and replacing unhealthy trees. Contractor shall:
- (A) Water plant material as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of one (1) inch of absorbed water per week, delivered in the form of rain or augmented by watering. Wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over planted areas. Watering of other adjacent areas or existing plant material shall be prevented.
 - (B) Use only trained and experienced personnel to prune seedlings. Prune only dead or broken material from installed plants. Retain the typical growth habit of individual plant material. Make clean cuts flush with the parent trunk. Remove improper cuts, stubs, dead, and broken branches.
 - (C) Control weeds by means of mowing, hand pulling, and/or herbicide applications as required. Utilize licensed applicators who are experienced with native and non-native plant identification to perform herbicide treatments who are experienced with native and non-native plant identification. Use herbicides in full conformation with label imitations and limit overspray and damage to off-target species.

END OF SECTION 35 93 25

PART 1 – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install coir fabric bank protection as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

1.1 Submittals.

- (A) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence of materials received and used to install coir fabric bank protection.
- (B) Contractor shall photograph each critical element of the installation, including footer rock, back fill, dense grade, bentonite, chinking, geotextile fabric, and all other covered work. Photo documentation shall be submitted with Contractor daily/weekly reports and are considered incidental to the work.

PART 2 – MATERIALS

- 2.1 Coir Fabric. Coir fabric shall be Type I as specified in Section 31 05 20.

PART 3 – EXECUTION

3.1 Installation. Contractor shall:

- (A) Prepare soil, including grading, topsoil, seed, and mulch. The surface of the soil should be smooth and free of rocks, roots and other obstructions.
- (B) Start on the bankfull bench by anchoring fabric in a six (6) inch deep and six (6) inch wide anchor trench. Note: The fabric trench shall be a minimum of five (5) feet upslope the top break in slope of the bank. Place fabric, stake as specified in Section 31 05 20, backfill, and compact.
- (C) Roll the fabric down the slope (recommended for steep slopes) or across the slope. Stake as specified in Section 31 05 20. Be sure to lay fabric loosely on the ground allowing a good contact between soil and fabrics.
- (D) When fabric splicing is necessary, use a six (6) inch overlap. The overlap shall always be with the upstream fabric overlapping the downstream fabric. If overlapping is necessary from top to bottom, the upslope fabric shall overlap the downslope fabric.

- 3.2 Tolerances. All elevations shall be within two-tenths of one (0.2) foot of the Drawings.

END OF SECTION 35 42 60

PART 1 – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install constructed riffles with wood as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

1.1 Submittals.

- (A) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence of materials received and used to install constructed riffles with wood.
- (B) Contractor shall photograph each critical element of the installation, including footer rock, back fill, dense grade, bentonite, chinking, geotextile fabric, and all other covered work. Photo documentation shall be submitted with Contractor daily/weekly reports and are considered incidental to the work.

- 1.2 Restrictions. Rock will be required as backfill where over-excavation has occurred or where necessary to secure contact between the irregular rock shapes and the existing earth material. Rock necessary to secure contact between irregular rock shapes and existing earth material shall be compacted consistent with the adjacent existing earth material.

PART 2 – MATERIALS

- 2.1 Rock. All rock shall consist of clean limestone of the specified size; hard, durable, and angular in shape, and resistant to weathering. Rock shall not contain deleterious amounts of shale, as determined by Engineer. Porous or friable rock shall be rejected. Slag or recycled aggregate shall be rejected. Refer to the Drawings for required rock dimensions.
- 2.2 Dense Graded Aggregate. Dense graded aggregate shall conform to KYTC Standard Specifications, Section 805.
- 2.3 Boulders. Boulders shall be angular, flat, or cubed durable sandstone, limestone, granite, or dolomite rock of sufficient hardness to resist weathering. Boulders shall be free of shale, cracks, and defects. Refer to the Drawings for required minimum median axis boulder dimensions. Boulder source must be submitted to Engineer for approval.
- 2.4 Logs. Logs shall be from hardwood trees free of rot and/or disease with appropriate dimensions provided on the Drawings. Logs shall be relatively straight and limbs trimmed as needed for installation. Some small limbs can remain on the log.
- 2.5 Coir Fabric. Coir fabric shall be Type I as specified in Section 31 05 20.

PART 3 – EXECUTION

3.1 Installation. Contractor shall:

- (A) Shape the channel to the approximate grades specified.
- (B) Place the crest stones across the head of riffle and key into banks, as shown on the Drawings, maintaining a tight fit across the channel bed. Construction should begin at the channel invert and work towards the top of the channel, with the row of crest stone extending into the banks a minimum of five (5) feet.

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- (C) Place crest stones tightly together, minimizing gaps. The largest fill stone shall be placed immediately downstream of the crest stones to provide support. Backfill and chink all voids with dense graded aggregate, as defined on the Drawings. Fill the voids on the upstream side of the row of crest stones with dense graded aggregate material such that water will flow over the surface of the crest stones rather than through gaps in the boulders. Once the crest stone is installed, backfill with fill stone and compact to within a foot of the final grade.
 - (D) Place additional crest stone throughout the riffle such that 25 percent of the riffle face is crest stone, as indicated in Drawings.
 - (E) Prior to installation of fill stone throughout the riffle structure, place coir fabric Type I along the bank for the length of the riffle as shown on the Drawings. The coir fabric shall be trenched in at the toe of the slope a minimum of one (1) foot deep and may need to be cut to avoid the row of crest stone. Minimize the amount of cut made to the coir fabric.
 - (F) Once the coir fabric is trenched in at the toe of the slope, add fill stone and logs to the bed of the riffle until final grade is met as shown on the Drawings. As with the crest stones, the elevation of the fill stone shall gradually increase towards the banks, with the invert elevation being in the center of the riffle. Verify riffle slope is as indicated in the stream profiles on the Drawings.
 - (G) Install each log within the riffle bed into the bank a minimum of five (5) feet as indicated on the Drawings. Secure logs within the banks with anchor rock as indicated on the Drawings. The coir fabric may need to be cut to allow for the installation of the logs within the stream banks. If logs onsite are not long enough to reach the requirement, off site logs can be brought in or multiple logs can be secured together with prior written approval by Engineer. The logs shall be partially buried, with a maximum of 50 percent of the diameter exposed. If needed, fill stone may need to be installed as a footer for the logs in order to meet the necessary elevations. The logs should increase in elevation moving toward the banks, as with the crest stones.
 - (H) Unfold coir fabric onto stream bed and place fill stone, as defined on the Drawings, on the stream low flow bench and/or bank and compact to three (3) inches less than grade indicated on the Drawings. Top fill stone on the stream bank with soil to grade and seed and mulch as indicated on the Drawings.
 - (I) Once the fill stone, soil, and seed has been placed on both stream banks, cover the banks and floodplain with coir fabric as shown on the Drawings.
- 3.2 Tolerances. All stone shall be within one-tenth of one (0.1) foot of the Drawings. However, the structure is not to be a smooth, uniform structure, and it is preferred if there are variations within the structure to provide a natural look as well as providing a rough surface.

END OF SECTION 35 49 56

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install rock A-vanes as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

I.1 Submittals.

- (A) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence of materials received and used to install rock A-vanes.
- (B) Contractor shall photograph each critical element of the installation, including footer rock, back fill, dense grade, bentonite, chinking, geotextile fabric, and all other covered work. Photo documentation shall be submitted with Contractor daily/weekly reports and are considered incidental to the work.

- I.2 Restrictions. Rock will be required as backfill where over-excavation has occurred or where necessary to secure contact between the irregular rock shapes and the existing earth material. Rock necessary to secure contact between irregular rock shapes and existing earth material shall be compacted consistent with the adjacent existing earth material.

PART 2 – MATERIALS

- 2.1 Rock. All rock shall consist of clean limestone of the specified size; hard, durable, and angular in shape, and resistant to weathering. Rock shall not contain deleterious amounts of shale, as determined by Engineer. Porous or friable rock shall be rejected. Slag or recycled aggregate shall be rejected. Refer to the Drawings for required rock dimensions.
- 2.2 Dense Graded Aggregate. Dense graded aggregate shall conform to KYTC Standard Specifications, Section 805.
- 2.3 Boulders. Boulders shall be angular, flat, or cubed durable sandstone, limestone, granite, or dolomite rock of sufficient hardness to resist weathering. Boulders shall be free of shale, cracks, and defects. Refer to the Drawings for required minimum median axis boulder dimensions. Boulder source must be submitted to Engineer for approval.
- 2.4 Bentonite. All bentonite shall be granular sodium bentonite clay with an expansion factor of 10x.

PART 3 – EXECUTION

3.1 Installation. Contractor shall:

- (A) Construct rock A-vane structures by first shaping the bankfull channel to the grades specified. Excavate enough bed material to place the rocks.
- (B) Mark the location of the rocks for rock A-vane structures. Excavate the pool per the lines and grades on the Drawings.
- (C) Place footer rocks. Note the elevations required to set the grade for the surface rock. Footer rocks shall be placed tightly together and chinked to minimize gaps as indicated on the Drawings. The top of footer rocks shall be touching adjacent header rocks to minimize chinking. Footer rocks should be installed similar to “keystone” structures, in a fashion that

single footer rocks can't be dislodged in the downstream direction. Gaps in the top elevation of footer rocks of more than one-eighth of one inch will be rejected. The vane arms of the rock vane shall slope up to the bank at elevations and slopes indicated on the Drawings.

- (D) Place surface rocks per lines and grades on the Drawings, starting from the invert and work toward both banks. These rocks shall be placed tightly together and chinked (between each other and between surface rocks and footer rocks) using dense graded aggregate to minimize gaps as indicated in Drawings. The top of surface rocks shall be touching adjacent surface rocks to minimize chinking. Surface rocks should be installed similar to "keystone" structures, in a fashion that surface rocks can't be dislodged in the downstream direction. Gaps in the top elevation of surface rocks of more than one-eighth of one inch will be rejected. All surface boulders shall be offset upstream from the footer boulders to allow for a "splash pad" as specified on the Drawings. Fill the voids on the upstream side of surface rocks (and between surface and footer rocks) with dense graded aggregate material and seal with bentonite such that water will flow over the surface rocks rather than through gaps in the rocks. Hand placement of material may be necessary to adequately fill voids between boulders.
- (E) Extend rocks into banks to create a sill as shown on Drawings. Sill rocks shall be buried just below the ground surface such that the top of the rock does not protrude from the ground and forms a smooth surface.
- (F) Excavate the pool downstream of structure per lines and grades shown on Drawings.
- (G) Backfill pools with material specified on Drawings.
- (H) Restore stream banks to the lines and grades specified on the Drawings.

3.2 Tolerances. All stone shall be within one-tenth of one foot (0.1) of the Drawings.

PART 1 – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install rock and log A-vanes as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

1.1 Submittals.

- (A) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence of materials received and used to install rock and log A-vanes.
- (B) Contractor shall photograph each critical element of the installation, including footer rock, back fill, dense grade, bentonite, chinking, geotextile fabric, and all other covered work. Photo documentation shall be submitted with Contractor daily/weekly reports and are considered incidental to the work.

- 1.2 Restrictions. Rock will be required as backfill where over-excavation has occurred or where necessary to secure contact between the irregular rock shapes and the existing earth material. Rock necessary to secure contact between irregular rock shapes and existing earth material shall be compacted consistent with the adjacent existing earth material.

PART 2 – MATERIALS

- 2.1 Rock. All rock shall consist of clean limestone of the specified size; hard, durable, and angular in shape, and resistant to weathering. Rock shall not contain deleterious amounts of shale, as determined by Engineer. Porous or friable rock shall be rejected. Slag or recycled aggregate shall be rejected. Refer to the Drawings for required rock dimensions.
- 2.2 Dense Graded Aggregate. Dense graded aggregate shall conform to KYTC Standard Specifications, Section 805.
- 2.3 Boulders. Boulders shall be angular, flat, or cubed durable sandstone, limestone, granite, or dolomite rock of sufficient hardness to resist weathering. Boulders shall be free of shale, cracks, and defects. Refer to the Drawings for required minimum median axis boulder dimensions. Boulder source must be submitted to Engineer for approval.
- 2.4 Logs. Logs shall be from hardwood trees free of rot and/or disease with appropriate dimensions provided in the Drawings. Logs shall be straight and limbs trimmed generally flush.
- 2.5 Geotextile Fabric. Geotextile fabric shall be Type I as specified in Section 31 05 19.
- 2.6 Nails. Two (2) inch galvanized roofing nails with plastic caps.
- 2.7 Bentonite. All bentonite shall be granular sodium bentonite clay with an expansion factor of 10x.

PART 3 – EXECUTION

3.1 Installation. Contractor shall:

- (A) Construct rock and log A-vane structures by first shaping the bankfull channel to the grades specified. Excavate enough bed material to place the rocks, log, and geotextile fabric.

- (B) Mark the location of the rocks and log for rock and log A-vane structure.
- (C) Excavate the pool per the lines and grades on the Drawings.
- (D) Secure the geotextile fabric to the log, nailing with two- (2) inch galvanized roofing nails the entire length of the log, six (6) inches on center. Extend fabric to the location where the upstream footer rock will be installed.
- (E) Place footer rocks and log. Note the elevations required to set the grade for the surface rock and log (notches). These rocks shall be placed tightly together and chinked to minimize gaps as indicated on the Drawings. The top of footer rocks shall be touching adjacent footer rocks to minimize chinking. Footer rocks should be installed similar to “keystone” structures, in a fashion that single footer rocks can’t be dislodged in the downstream direction. Gaps in the top elevation of footer rocks of more than one-eighth of one inch will be rejected. The vane arms of the rock vane shall slope up to the bank at elevations and slopes indicated on the Drawings. The log shall be placed on and between footer rocks at the location shown on the Drawing. Chink any gaps between rocks and log using dense graded aggregate to avoid having gaps between the log on footer rocks.
- (F) All logs shall be offset upstream from the footer boulders to allow for a “splash pad” as specified on the Drawings. Fill the voids on the upstream side of the logs (and between surface rocks/logs and footer rocks) with dense graded aggregate and seal with bentonite such that water will flow over the logs rather than through gaps. Hand placement of material may be necessary to adequately fill voids.
- (G) Place surface rocks per lines and grades on the Drawings, starting from the invert and work toward both banks. These rocks shall be placed tightly together and chinked (between each other and between surface rocks/logs and footer rocks) using dense graded aggregate to minimize gaps as indicated in Drawings. The top of surface rocks shall be touching adjacent surface rocks to minimize chinking. Surface rocks should be installed similar to “keystone” structures, in a fashion that surface rocks can’t be dislodged in the downstream direction. Gaps in the top elevation of surface rocks of more than one-eighth of one inch will be rejected. All surface boulders shall be offset upstream from the footer boulders to allow for a “splash pad” as specified on the Drawings. Fill the voids on the upstream side of surface rocks (and between surface and footer rocks) with dense graded aggregate material such that water will flow over the surface rocks rather than through gaps in the rocks. Hand placement of material may be necessary to adequately fill voids between boulders.
- (H) Extend rocks into bank to create a sill as shown on Drawings. Sill rocks shall be buried just below the ground surface such that the top of the rock does not protrude from the ground and forms a smooth surface.
- (I) Excavate the pool downstream of structure per lines and grades shown on Drawings.
- (J) Backfill pools with material specified on Drawings.
- (K) Notch logs as shown on Drawings.
- (L) Do not leave exposed filter fabric in the channel; trim any exposed fabric so that it is not visible after final grading.
- (M) Restore stream banks to the lines and grades specified on the Drawings.

3.2 Tolerances. All stone shall be within one-tenth of one foot (0.1) of the Drawings.

END OF SECTION 35 49 76

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install log steps as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

1.1 Submittals.

- (A) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence of materials received and used to install log steps.
- (B) Contractor shall photograph each critical element of the installation, including footer rock, back fill, dense grade, bentonite, chinking, geotextile fabric, and all other covered work. Photo documentation shall be submitted with Contractor daily/weekly reports and are considered incidental to the work.

- 1.2 Restrictions. Rock will be required as backfill where over-excavation has occurred or where necessary to secure contact between the irregular rock shapes and the existing earth material. Rock necessary to secure contact between irregular rock shapes and existing earth material shall be compacted consistent with the adjacent existing earth material.

PART 2 – MATERIALS

- 2.1 Rock. All rock shall consist of clean limestone of the specified size; hard, durable, and angular in shape, and resistant to weathering. Rock shall not contain deleterious amounts of shale, as determined by Engineer. Porous or friable rock shall be rejected. Slag or recycled aggregate shall be rejected. Refer to the Drawings for required rock dimensions.
- 2.2 Dense Graded Aggregate. Dense graded aggregate shall conform to KYTC Standard Specifications, Section 805.
- 2.3 Boulders. Shall be angular, flat, or cubed durable sandstone, limestone, granite, or dolomite rock of sufficient hardness to resist weathering. Boulders shall be free of shale, cracks, and defects. Refer to the Drawings for required minimum median axis boulder dimensions. Boulder source must be submitted to Engineer for approval.
- 2.4 Logs. Logs shall be from hardwood trees free of rot and/or disease with appropriate dimensions provided on the Drawings. Logs shall be straight and limbs trimmed generally flush.
- 2.5 Geotextile Fabric. Geotextile fabric shall be Type I as specified in Section 31 05 19.
- 2.6 Nails. Two (2) inch galvanized roofing nails with plastic caps.
- 2.7 Bentonite. All bentonite shall be granular sodium bentonite clay with an expansion factor of 10x.

PART 3 – EXECUTION

3.1 Installation. Contractor shall:

- (A) Construct log step structures by first shaping the bankfull channel to the grades and line specified. Excavate enough bed material to place the footer rocks and logs. Mark the location of the rocks and logs for log step structures.
- (B) Place the footer rocks. Note the elevations required to set the grade for logs (notches). These rocks shall be placed tightly together and chinked to minimize gaps as indicated on the Drawings. The top of footer rocks shall be touching adjacent footer rocks to minimize chinking. Footer rocks should be installed similar to “keystone” structures, in a fashion that single footer rocks can’t be dislodged in the downstream direction. Gaps in the top elevation of footer rocks of more than one-eighth of one inch will be rejected.
- (C) Secure geotextile fabric to the log by nailing two (2) inch galvanized roofing nails the entire length of the log, six (6) inches on center.
- (D) Place logs. All logs shall be offset upstream from the footer boulders to allow for a “splash pad” as specified on the Drawings. Fill the voids on the upstream side of the logs (and between logs and footer rocks) with dense graded aggregate material and seal with bentonite such that water will flow over the logs rather than through gaps. Hand placement of material may be necessary to adequately fill voids.
- (E) Backfill over geotextile with material specified on Drawings.
- (F) Excavate the pool downstream of structure per lines and grades shown on Drawings.
- (G) Notch log as shown on Drawings.
- (H) Do not leave exposed filter fabric in the channel; trim any exposed fabric so that it is not visible after final grading.
- (I) Restore stream banks to the lines and grades specified on the Drawings.

3.2 Tolerances. Log step invert shall be within one-tenth of one foot (0.1) of the Drawings.

END OF SECTION 35 49 85

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install double log steps as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

1.1 Submittals.

- (A) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence of materials received and used to install double log steps.
- (B) Contractor shall photograph each critical element of the installation, including footer rock, back fill, dense grade, bentonite, chinking, geotextile fabric, and all other covered work. Photo documentation shall be submitted with Contractor daily/weekly reports and are considered incidental to the work.

- 1.2 Restrictions. Rock will be required as backfill where over-excavation has occurred or where necessary to secure contact between the irregular rock shapes and the existing earth material. Rock necessary to secure contact between irregular rock shapes and existing earth material shall be compacted consistent with the adjacent existing earth material.

PART 2 – MATERIALS

- 2.1 Rock. All rock shall consist of clean limestone of the specified size; hard, durable, and angular in shape, and resistant to weathering. Rock shall not contain deleterious amounts of shale, as determined by Engineer. Porous or friable rock shall be rejected. Slag or recycled aggregate shall be rejected. Refer to the Drawings for required rock dimensions.
- 2.2 Dense Graded Aggregate. Dense graded aggregate shall conform to KYTC Standard Specifications, Section 805.
- 2.3 Boulders. Boulders shall be angular, flat, or cubed durable sandstone, limestone, granite, or dolomite rock of sufficient hardness to resist weathering. Boulders shall be free of shale, cracks, and defects. Refer to the Drawings for required minimum median axis boulder dimensions. Boulder source must be submitted to Engineer for approval.
- 2.4 Logs. Logs shall be from hardwood trees free of rot and/or disease with appropriate dimensions provided on the Drawings. Logs shall be straight and limbs trimmed generally flush.
- 2.5 Geotextile Fabric. Geotextile fabric shall be Type I as specified in Section 31 05 19.
- 2.6 Nails. Two (2) inch galvanized roofing nails with plastic caps.
- 2.7 Bentonite. All bentonite shall be granular sodium bentonite clay with an expansion factor of 10x.

PART 3 – EXECUTION

3.1 Installation. Contractor shall:

- (A) Construct double log step structures by first shaping the bankfull channel to the grades and line specified.

- (B) Excavate enough bed material to place the footer rocks and logs. Mark the location of the rocks and logs for log step structures.
 - (C) Place footer rocks. Note the elevations required to set the grade for logs (notches). These rocks shall be placed tightly together and chinked to minimize gaps as indicated on the Drawings. The top of footer rocks shall be touching adjacent footer rocks to minimize chinking. Footer rocks should be installed similar to “keystone” structures, in a fashion that single footer rocks can’t be dislodged in the downstream direction. Gaps in the top elevation of footer rocks of more than one-eighth of one inch will be rejected.
 - (D) Place the logs and fabric as indicated on the Drawings.
 - (E) Secure geotextile fabric to both logs by nailing two (2) inch galvanized roofing nails the entire length of the log, six (6) inches on center. Backfill over geotextile with material specified on Drawings.
 - (F) All logs shall be offset upstream from the footer boulders to allow for a “splash pad” as specified on the Drawings. Fill the voids on the upstream side of the logs (and between logs and footer rocks) with dense graded aggregate material and seal with bentonite such that water will flow over the logs rather than through gaps. Hand placement of material may be necessary to adequately fill voids.
 - (G) Excavate the pool downstream of structure per lines and grades shown on Drawings.
 - (H) Notch logs as shown on Drawings.
 - (I) Do not leave exposed filter fabric in the channel; trim any exposed fabric so that it is not visible after final grading.
 - (J) Restore stream banks to the lines and grades specified on the Drawings.
- 3.2 Tolerances. Log step invert shall be within one-tenth of one foot (0.1) of the Drawings.

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install rock steps as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

1.1 Submittals.

- (A) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence of materials received and used to install rock steps.
- (B) Contractor shall photograph each critical element of the installation, including footer rock, back fill, dense grade, bentonite, chinking, geotextile fabric, and all other covered work. Photo documentation shall be submitted with Contractor daily/weekly reports and are considered incidental to the work.

- 1.2 Restrictions. Rock will be required as backfill where over-excavation has occurred or where necessary to secure contact between the irregular rock shapes and the existing earth material. Rock necessary to secure contact between irregular rock shapes and existing earth material shall be compacted consistent with the adjacent existing earth material.

PART 2 – MATERIALS

- 2.1 Rock. All rock shall consist of clean limestone of the specified size; hard, durable, and angular in shape, and resistant to weathering. Rock shall not contain deleterious amounts of shale, as determined by Engineer. Porous or friable rock shall be rejected. Slag or recycled aggregate shall be rejected. Refer to the Drawings for required rock dimensions.
- 2.2 Dense Graded Aggregate. Dense graded aggregate shall conform to KYTC Standard Specifications, Section 805.
- 2.3 Boulders. Boulders shall be angular, flat, or cubed durable sandstone, limestone, granite, or dolomite rock of sufficient hardness to resist weathering. Boulders shall be free of shale, cracks, and defects. Refer to the Drawings for required minimum median axis boulder dimensions. Boulder source must be submitted to Engineer for approval.
- 2.4 Bentonite. All bentonite shall be granular sodium bentonite clay with an expansion factor of 10x.

PART 3 – EXECUTION

3.1 Installation. Contractor shall:

- (A) Construct rock step structures by first shaping the bankfull channel to the grades specified.
- (B) Excavate enough bed material to place the rocks.
- (C) Mark the location of the rocks for rock step structures.
- (D) Place footer rocks. Note the elevations required to set the grade for the surface rock. These rocks shall be placed tightly together and chinked to minimize gaps as indicated on the Drawings. The top of footer rocks shall be touching adjacent footer rocks to minimize chinking. Footer rocks should be installed similar to “keystone” structures, in a fashion that

single footer rocks can't be dislodged in the downstream direction. Gaps in the top elevation of footer rocks of more than one-eighth of one inch will be rejected.

- (E) Place surface rocks per lines and grades on the Drawings, starting from the invert and work toward both banks. These rocks shall be placed tightly together and chinked (between each other and between surface rocks/logs and footer rocks) using dense graded aggregate to minimize gaps as indicated in Drawings. The top of surface rocks shall be touching adjacent surface rocks to minimize chinking. Surface rocks should be installed similar to "keystone" structures, in a fashion that surface rocks can't be dislodged in the downstream direction. Gaps in the top elevation of surface rocks of more than one-eighth of one inch will be rejected. All surface boulders shall be offset upstream from the footer boulders to allow for a "splash pad" as specified on the Drawings. Fill the voids on the upstream side of surface rocks (and between surface and footer rocks) with dense graded aggregate material such that water will flow over the surface rocks rather than through gaps in the rocks. Hand placement of material may be necessary to adequately fill voids between boulders.
- (F) Excavate the pool downstream of structure per lines and grades shown on Drawings.
- (G) Restore stream banks to the lines and grades specified on the Drawings.

3.2 Tolerances. Rock step invert shall be within one-tenth of one foot (0.1) of the Drawings.

PART I – GENERAL

Contractor shall furnish all materials, equipment, and labor required to install small woody debris complex as detailed on the Drawings, required by the Technical Specifications, or directed by Engineer.

1.1 Submittals.

- (A) Contractor shall furnish copies of the delivery tickets or other acceptable receipts as evidence of materials received and used to install small woody debris complex.
- (B) Contractor shall photograph each critical element of the installation, including footer rock, back fill, dense grade, bentonite, chinking, geotextile fabric, and all other covered work. Photo documentation shall be submitted with Contractor daily/weekly reports and are considered incidental to the work.

PART 2 – MATERIALS

- 2.1 Woody Materials. The woody material shall consist of logs with diameter and length specified on the Drawings. Small branches and root wad can remain on the logs but be trimmed as specified on the Drawings. Limbs shall be removed as needed to achieve installation and comply with the Drawings.

PART 3 – EXECUTION

3.1 Installation. Contractor shall:

- (A) Install small woody debris complex within the bed of a previously excavated channel in locations indicated on the Drawings.
- (B) Header log shall be anchored across the head of the structure as indicated on the Drawings.
- (C) Woody debris shall be pushed into the stream bed as indicated on the Drawings.

- 3.2 Tolerances. All logs and woody debris shall be within two-tenths of one foot (0.2) of the Drawings.

END OF SECTION 35 49 97